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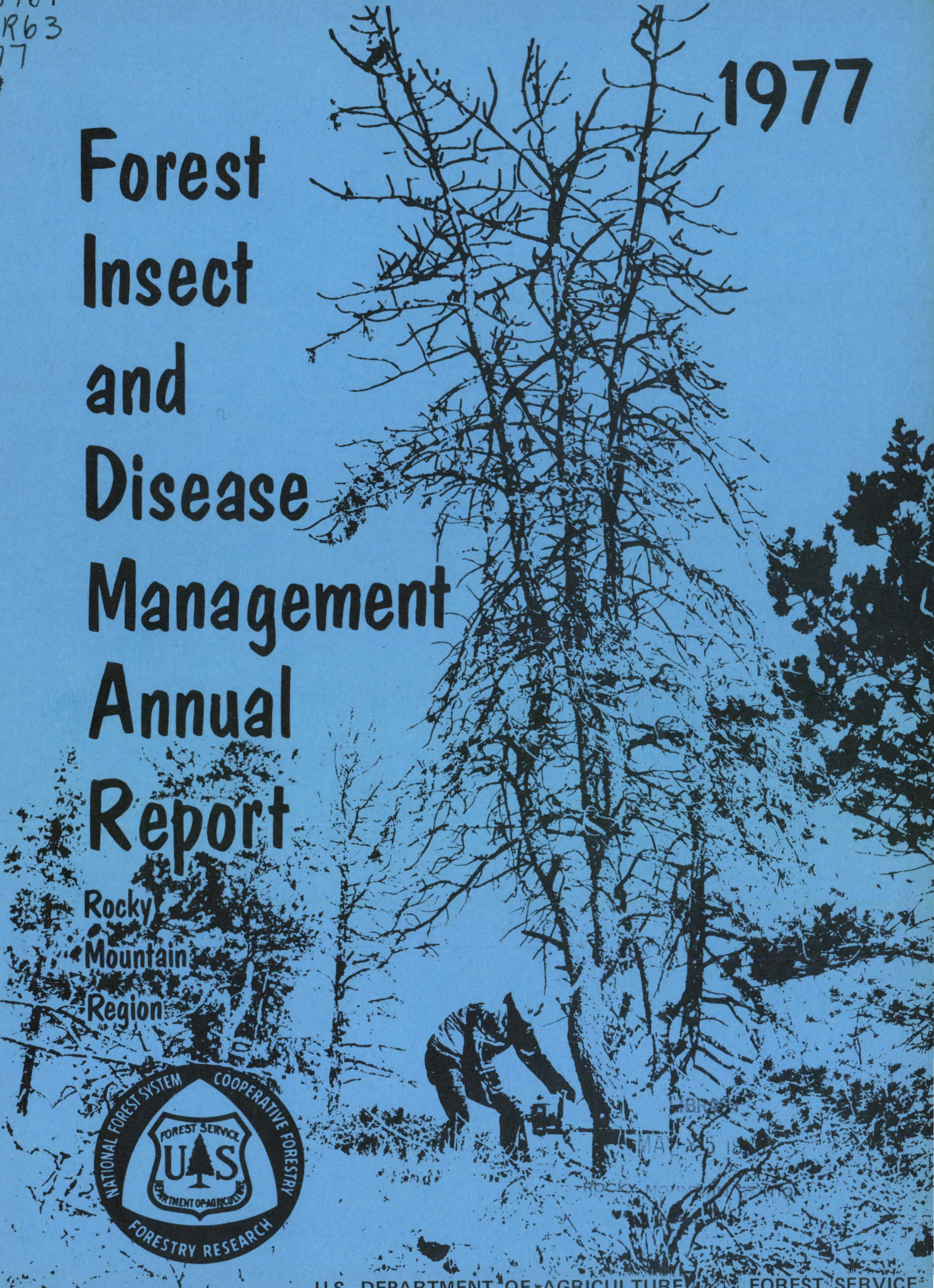
Forest Insect and Disease Management Annual Report

Rocky Mountain Region



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FOREST INSECT AND DISEASE MANAGEMENT
ANNUAL REPORT
ROCKY MOUNTAIN REGION
1977

by

David W. Johnson, Plant Pathologist

and

Vernon L. M. Creasap, Entomologist

April 1978

Forest Insect and Disease Management
State and Private Forestry
Rocky Mountain Region
USDA, Forest Service
11177 W. 8th Avenue
Lakewood, Colorado 80225

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ACKNOWLEDGMENT

Appreciation is extended to all the Federal and State personnel who contributed the information presented in this third annual report of insect and disease pests in Region Two. The following organizations submitted information for this report: Colorado State Forest Service, Colorado State University, Kansas State and Extension Forestry, Nebraska State and Extension Forestry, University of Nebraska Institute of Agriculture and Natural Resources, South Dakota State Division of Forestry, Wyoming State Forestry Division, and Rocky Mountain Forest and Range Experiment Station.

INTRODUCTION

Forest Insect and Disease Management (FIDM) is directed by the Forest Pest Control Act of 1947 to be responsible, on lands administered by the Forest Service, for prevention, detection, evaluation and suppression of forest insects and diseases. On lands administered by other Federal agencies FIDM is responsible for detection surveys and biological evaluations and for providing technical advice to land managers in forest insect and disease prevention and suppression. On non-Federal land, state agencies and private landowners are responsible for forest insect and disease control. A number of Federal forest management programs are available to assist state and private landowners, both financially and technically. These programs are administered through cooperative agreements with the states.

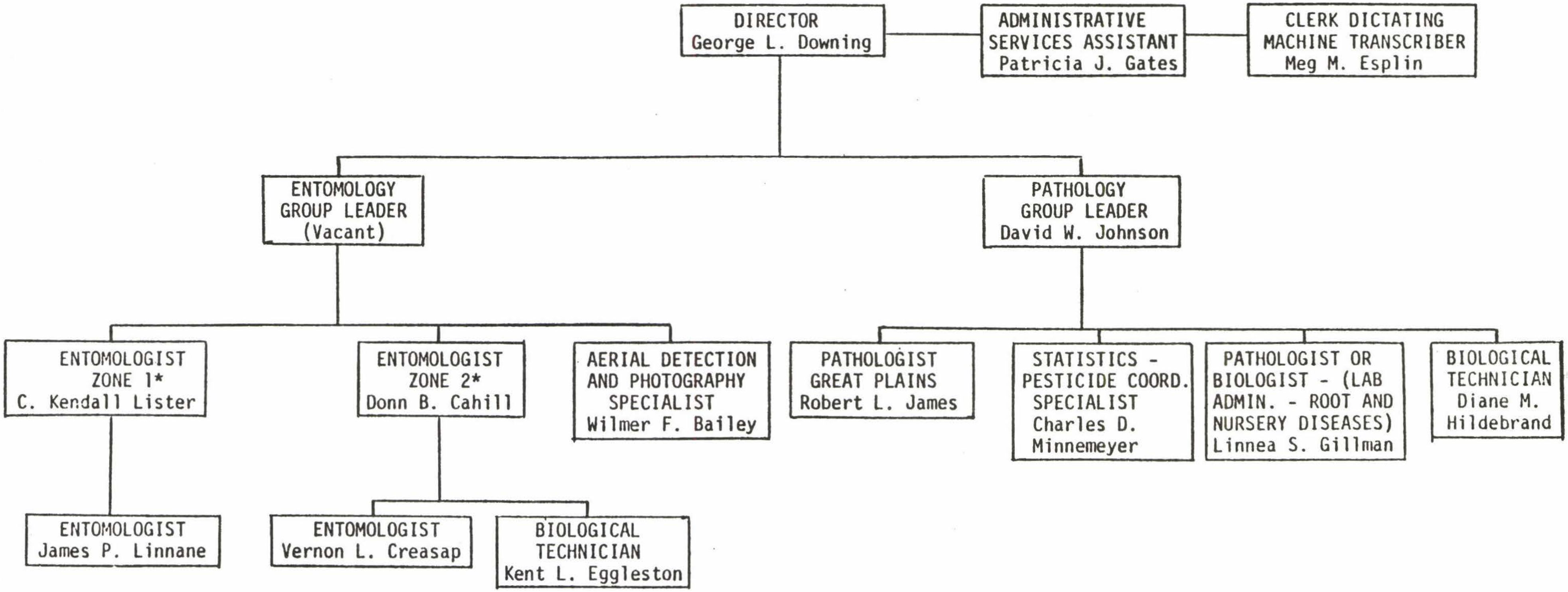
Ground and aerial surveys throughout the Region in 1977 were used to record forest insect and disease infestations. Some surveys were conducted in cooperation with the states of Colorado, Kansas, Nebraska, South Dakota, and Wyoming. In the Appendix, a map depicts the distribution of several of the major insects and diseases in the Region.

A detection reporting form (R-2 5200-2, see Appendix) is available from the USDA, Forest Service. Some states have similar forms. FIDM encourages the use of these forms by all forest resource land managers since a significant reduction of insect- and disease-caused losses can be realized by early reporting and prompt initiation of prevention or suppression measures.

Additional information on specific insect and disease pests may be requested from the FIDM Staff located at the Regional Office in Lakewood, Colorado. The current organization of the FIDM Staff is displayed on the following page.

FOREST INSECT AND DISEASE MANAGEMENT

ORGANIZATIONAL CHART



DIRECTOR
George L. Downing

ADMINISTRATIVE SERVICES ASSISTANT
Patricia J. Gates

CLERK DICTATING MACHINE TRANSCRIBER
Meg M. Esplin

ENTOMOLOGY GROUP LEADER
(Vacant)

PATHOLOGY GROUP LEADER
David W. Johnson

ENTOMOLOGIST ZONE 1*
C. Kendall Lister

ENTOMOLOGIST ZONE 2*
Donn B. Cahill

AERIAL DETECTION AND PHOTOGRAPHY SPECIALIST
Wilmer F. Bailey

PATHOLOGIST GREAT PLAINS
Robert L. James

STATISTICS - PESTICIDE COORD. SPECIALIST
Charles D. Minnemeyer

PATHOLOGIST OR BIOLOGIST - (LAB ADMIN. - ROOT AND NURSERY DISEASES)
Linnea S. Gillman

BIOLOGICAL TECHNICIAN
Diane M. Hildebrand

ENTOMOLOGIST
James P. Linnane

ENTOMOLOGIST
Vernon L. Creasap

BIOLOGICAL TECHNICIAN
Kent L. Eggleston

* Zone 1 - Colorado; Zone 2 - Kansas, Nebraska, South Dakota and Wyoming

1/9/78

INSECT AND DISEASE CONDITIONS IN BRIEF

High levels of mortality of ponderosa pine from the mountain pine beetle continued in the Black Hills of South Dakota and Wyoming, although damage appeared to be reduced from 1976. Mountain pine beetle populations continued to increase in ponderosa pine along the Front Range of Colorado and in the Bighorn Mountains in Wyoming.

In lodgepole pine type, in Middle Park of Colorado, the mountain pine beetle continued the decline first reported in 1976. There were a few small scattered groups of pine mortality noted during aerial surveys on the Medicine Bow National Forest. Insect populations near Atlantic City, Wyoming and on the southern Shoshone National Forest are expected to remain at high levels.

Western spruce budworm activity was reported on all National Forests in Region 2 except the Black Hills and Nebraska National Forests. The most widespread activity occurred in Colorado. Large infestations of tent caterpillar were reported in southern Colorado. A large infestation of the flocculent fir aphid was reported in the vicinity of Rifle, Colorado. Several insects continued to damage plantations and shelterbelts in the Plains states. Damage on shade trees by several insects was reported to be generally light to moderate in urban areas.

Lodgepole pine dwarf mistletoe and comandra rust continued as the most significant disease problems in the lodgepole pine forests in the Rocky Mountain Region. Recently developed management guidelines and yield programs provide valuable tools for the land manager in evaluating various stands for treatment. Shoestring root rot commonly occurs throughout the Region, however, losses appear insignificant. Additional work is needed to define the damage caused by this disease in all forest types in the Region.

The addition of forest pest specialists to the State Foresters' staffs (through the Cooperative Forest Pest Management Act) in Kansas (1977), Nebraska (1975) and South Dakota (1975), resulted in increased attention to the survey and assessment of various insect and disease pests throughout the Great Plains. Diplodia tip blight was the most destructive disease of pines in Kansas and Nebraska. Noteworthy diseases of eastern redcedar included Phomopsis twig blight and Kabatina tip dieback. Diseases of hardwoods in the Great Plains included heart rot of green ash, a decline of hackberry and walnut, canker of Russian-olive, Dutch elm disease, oak wilt and Verticillium wilt of maple and

Russian-olive. Weather damage was reported as quite common in widely scattered areas on conifers and hardwoods. Low winter temperatures experienced in 1976 - 1977 coupled with drought during 1977 placed stress on vegetation throughout the Region. Nursery diseases including Pythium and Fusarium root rots, grey mold and Phomopsis blight, continued to plague several of the nurseries.

Several projects involving ectomycorrhizal fungi were initiated this past year. Evaluations of the effectiveness of mycorrhizae to conifers in the Region will be available in 1978 - 1979.

STATUS OF INSECTS

BARK BEETLES

MOUNTAIN PINE BEETLE: *Dendroctonus ponderosae*
Distribution Map, Fig. 1

Mountain pine beetle (MPB) infested ponderosa pine throughout the Front Range of Colorado just north of the Wyoming State line south to the Sangre de Cristo Mountains and the Spanish Peaks. The beetle also infested ponderosa pine along the eastern slopes of the Bighorn Mountains and throughout most of the Black Hills of South Dakota and Wyoming.

It is estimated that approximately 1,250,000 ponderosa pine were infested by MPB on lands of all ownerships along the Front Range of Colorado in 1977. This was an increase of 25 percent over 1976. Approximately 168,000 infested ponderosa pine were treated or removed on the Colorado Front Range. This is about 17 percent of the trees infested during 1976. There were approximately 1,500 trees infested in the Bighorn Mountains during 1977.

There were approximately 220,000 to 255,000 ponderosa pine infested in the Black Hills during 1977, a substantial reduction over 1976. Salvage logging of 1976 infested ponderosa pine, coupled with timber sales to improve stand conditions, continued.

The most effective way of controlling the mountain pine beetle is reducing growing stock levels to 80 to 90 or below, depending on site. Salvaging infested trees utilizes trees which would otherwise go to waste. The combination of the two procedures will reduce the susceptibility of the stands to mountain pine beetle attack and reduce population pressure on the remaining stands.

The South Dakota Division of Forestry treated infested trees by felling and burning, and drenching felled trees with ethylene dibromide or salvage logging a total of 89,787 infested trees. The Wyoming Forestry Division treated 15,188 infested trees. Salvage logging on the Black Hills National Forest removed 225,925 infested trees. A total of 330,900 ponderosa pines infested in

1976 were treated or removed from all ownerships in the Black Hills during 1977.

Mountain pine beetle in lodgepole pine in Colorado generally appears to be on the decrease, as in 1976. Control efforts on the Medicine Bow National Forest seem to have reduced insect losses to only a few small (10 or less) scattered groups of trees.

Extensive mortality of lodgepole pine and limber pine on the Shoshone National Forest continued. The outbreak at South Pass and Atlantic City, Wyoming continued to spread into adjacent stands. It was estimated, from aerial and ground surveys, that approximately 190,000 lodgepole pine and limber pine were infested by mountain pine beetle in 1977. Mortality of lodgepole pine and limber pine on other parts of the Shoshone National Forest was reported.

SPRUCE BEETLE: *Dendroctonus rufipennis*

Spruce beetle populations have been low throughout the Region. Small scattered pockets were observed on the Rio Grande, San Juan and Grand Mesa, Gunnison and Uncompahgre National Forests. During the winter of 1976 - 1977 there was some spruce blowdown on the Routt and Arapaho and Roosevelt National Forests. Plans are underway to salvage the blowdown, so the potential for spruce beetle build-up in these areas will be reduced. The beetle was also reported in road and logging slash on the Bighorn National Forest. This population will be evaluated in 1978.

DOUGLAS-FIR BEETLE: *Dendroctonus pseudotsugae*

A small group of Douglas-fir, killed by the Douglas-fir beetle in 1976, was found on the Pike and San Isabel National Forests southwest of Deckers, Colorado. No newly infested trees were found in the vicinity of the dead trees. Scattered mortality was reported on the White River National Forest, and on private lands near the Arapaho and Roosevelt National Forests.

WESTERN BALSAM BARK BEETLE: *Dryocetes confusus*
Fig. 2

Pockets of subalpine fir mortality were found on the Arapaho and Roosevelt, Routt, White River, and San Juan National Forests. One pocket of white fir mortality was found on the San Juan National Forest. There also was light mortality on the Shoshone National Forest in the West Long Creek drainage on the Wind River District.

PINE ENGRAVER: *Ips* spp.
Fig. 1

Pinyon mortality in Mesa Verde National Park occurred from a combination of root diseases and engraver beetles. The black stain root disease, *Verticicladiella wagenerii,* kills pinyon. The engraver beetle population builds up in the root disease-weakened or recently killed trees until there is no dead host material available. The insect, which usually invades only weakened or recently killed trees, then infests living trees beyond the area of root disease mortality. After a couple of years the beetle population declines and the root disease becomes dominant, until there is enough weakened or recently dead trees to enable the beetle population to build-up again. This cycle has been continuing for many years in this area and is expected to continue. It is planned for an entomologist and a pathologist to evaluate the associated damage in 1978. *Ips pini* was found associated with pinyon mortality from shoestring root rot, *Armillariella mellea,* north of Cotopaxi, Colorado.

DEFOLIATORS

WESTERN SPRUCE BUDWORM: *Choristoneura occidentalis*
Distribution Map, Fig. 3

The western spruce budworm continued to cause heavy defoliation in Colorado. The budworm caused noticeable defoliation on all National Forests in the Region except the Black Hills and Nebraska National Forests. Defoliation was most extensive on the National Forests in Colorado. Aerial surveys indicated that more than 650,000 acres of Douglas-fir, spruce and true fir were infested by the insect.

DOUGLAS-FIR TUSSOCK MOTH: *Orgyia pseudotsugata*

The Douglas-fir tussock moth remained a problem on ornamental fir and spruce in Denver, Boulder, Colorado Springs, and Fort Collins, Colorado. No defoliation was noted in natural forests, although the insect was trapped with pheromone outside these communities.

TENT CATERPILLAR: *Malacosoma* spp.; *Archips cerasivorana*

Distribution Map, Fig. 3

Heavy infestations of the western tent caterpillar, *Malacosoma californicum,* were found on the San Juan National Forest near Pagosa Springs, Colorado and on the Pike and San Isabel National Forests near Spanish Peaks. Infestations were also noticeable on private lands near LaVeta Pass, Colorado. Other tent caterpillars were reported as moderate to heavy in South Dakota and on the Arapaho and Roosevelt National Forests. Infestations of the ugly nest caterpillar, *Archips cerasivorana,* were found in aspen stands in Routt, Larimer and Douglas counties, Colorado.

FALL WEBWORM: *Hyphantria cunea*

Moderate populations of the fall webworm were found on the Pike and San Isabel National Forests in Clear Creek Canyon west of Golden, Colorado, along the Arkansas River and in Oak Creek Canyon west and south of Canon City, Colorado. The insect was also reported in Delta, Logan, Yuma, Las Animas, and Huerfano counties, Colorado.

WHITE FIR NEEDLE MINER: *Epinotia meritana*

A moderate infestation of the white fir needle miner continues on private lands in Pass Creek drainage near LaVeta, Colorado. The population appeared to be increasing and spreading to the south and west onto the Rio Grande National Forest.

TIP MOTHS: *Rhyacionia* spp.

Several species of pine tip moths caused extensive damage to nursery stock and ornamental pines in the eastern lowlands of Colorado. The Nantucket pine tip moth, *R. frustrana,* caused scattered heavy damage on ornamental plantings in eastern Kansas. The western pine tip moth, *R. bushnelli* was reported throughout South Dakota, with scattered severe damage to plantings in the eastern part of the state.

PITCH-NODULE MOTHS: *Petrova* spp.

Pitch-nodule moths caused scattered moderate to heavy damage to ponderosa pine plantings in eastern Colorado and throughout Nebraska. Pinyon was attacked in Colorado, ponderosa pine was infested in Nebraska. *P. metallica* continues to cause stunting, deformity, and growth loss in a ponderosa pine provenance planting at the South Dakota State Division of Forestry, Big Sioux Conifer Nursery at Watertown, South Dakota and Alliance, Nebraska.

ELM LEAF BEETLE: *Pyrralta luteola*

In the past two years the range and intensity of the beetle has expanded northward in South Dakota. Communities with known problems in 1977 included Pierre, Huron, Sioux Falls, and Yankton, South Dakota. Rapid City also experienced some defoliation problems, but not as severe as those in the eastern part of the state. In several areas of heavy infestation, there appeared to be a die-off of larvae. It is unknown what caused this situation. Heavy defoliation of ornamental elms continues in the major communities of Colorado and Kansas.

ELM SPANWORM: *Ennomos subsignarius*

The elm spanworm was reported for the first time in South Dakota.

PINE WEBWORM: *Tetrolopha robustella* (unconfirmed identification)

A webmaking defoliator of ponderosa pine was found at four locations in Boulder and Larimer counties, Colorado. The larvae and damage resembled those of the pine webworm or a close relative. Adults have not as yet been successfully reared for a confirmed identification. If the identification is confirmed, the known range of the insect will be extended over 900 miles from its nearest known limit of Minnesota.

PINE SAWFLY: *Neodiprion fulviceps*

Pine sawfly infestations were reported from Arthur, Garfield, Johnson, Logan, Saunders, Thurston, and Valley counties, Nebraska. Sawfly damage was also reported in the Black Hills of South Dakota and in small scattered groups to the east. All pockets of damage were under five acres.

ZIMMERMAN PINE MOTH: *Dioryctria zimmermani*
Distribution Map

The Zimmerman pine moth was found in seven new counties in Nebraska: Arthur, Buffalo, Dawson, Greeley, Hall, Howard, and McPherson. This insect continues to be the single most important insect pest of pines in the state. The insect was also reported, for the first time, in Phillips county, Colorado, which borders the Nebraska infestation.

SUCKING INSECTS

FLOCCULENT FIR APHID: *Cinara occidentalis*
Distribution Map

Approximately 8,000 acres of Bureau of Land Management and National Forest Service Lands surrounding Rifle, Colorado were heavily infested by the flocculent fir aphid. The aphid caused much mortality of subalpine fir.

OTHER NOTEWORTHY INSECTS: (see Table 1, Appendix)

STATUS OF DISEASES

DWARF MISTLETOES

LODGEPOLE PINE DWARF MISTLETOE: *Arceuthobium americanum*

This mistletoe continues to be one of the most important disease problems in lodgepole pine stands in the Rocky Mountain Region. It is estimated that 50 percent of all commercial lodgepole pine forests in the Region are infested with this parasite. Disease losses are most severe in partial cut stands where dwarf mistletoe was disregarded when harvesting stands. Infected residual trees provide for additional spread and intensification of the disease. Heavily infested stands have about half the volume and twice the mortality rate of non-infested stands on comparable sites. A comparison of estimated acreages infested by size classes for the Bighorn, Shoshone and Medicine Bow National Forests is shown in Table 2. This provides some scope to the problem in this Region. The major impacts of the disease are growth loss and mortality.

Lodgepole pine dwarf mistletoe was collected for the first time on Engelmann spruce in Wyoming. The infected tree was found on East Mesa, Bighorn National Forest. The cross-over of *A. americanum* to spruce is a rare occurrence.

ROOT DISEASES

SHOESTRING ROOT ROT: *Armillariella mella*

During 1977 an evaluation was made of *A. mellea* in a 30-year-old lodgepole pine stand (average diameter 4.3 inches, average height 23 feet) that had been thinned in 1964. The stand was located on Buckhorn Creek, Arapaho and Roosevelt National Forests.

The stand was first surveyed in 1959 and much mortality (about 2 percent per year) caused by *A. mellea* was noted at that time. In 1977, 84 1/100 acre plots were examined throughout the stand. All trees over 3 feet tall were tallied. A total of 1,085 trees were examined (1,292 trees/acre) and only 48 were killed by *A. mellea* (48 trees/acre). None of the dead trees would have been suitable as crop trees; thus the loss was minimal. Also none of the disease centers were large enough to result in understocking of the stand.

The shoestring root-rot fungus caused mortality in the pinyon-juniper type on BLM and privately-owned lands north of Cotopaxi, Colorado. Several areas with pockets of dying and dead trees were evaluated in 1976. This year 20 to 30 acres of infected trees were located several miles away on Arkansas Mountain. *Ips pini* was common in diseased trees.

STEM DISEASES

COMANDRA BLISTER RUST: *Cronartium comandrae*

This rust is one of the most important diseases of lodgepole pine in the Region, especially in stands over 80 years old.

Current disease loss consists primarily of spike tops, growth loss and mortality in pole- and sawtimber-size trees. Data collected from 49 temporary plots established in the Bighorn, Medicine Bow, and Shoshone National Forests showed a range in rust incidence from 4 to 73.9 percent of the trees. The data does not necessarily represent the average condition of lodgepole pine stands in these forests but a range of stand conditions in sampled rust-infested stands.

The greatest concentration of rust incidence and damage to lodgepole pine was observed along the north side of the upper Wind River drainage in the Shoshone National Forest in western Wyoming. The dilemma now facing the land manager, particularly for the Wind River District, is what to do with rust-infested stands.

Recently a valuable tool has been developed for use in rust-infested stands. A numerical rating scheme called comandra rust rating (CRR), similar to the dwarf mistletoe rating (DMR), has been developed for rating diseased trees. Average estimates of the incidence and intensity (disease rating) of the rust in lodgepole pine stands collected during disease surveys or stand exams can be used as inputs into the yield program, RMYLD, to project the effect of these diseases over the rotation age. Yield projections for infected stands are then used to evaluate various management treatments and their biologic and economic feasibility and to rate the priority of various stands for treatment.

Additional data on comandra rust were collected on the Medicine Bow National Forest during 1977 while conducting a disease survey for lodgepole pine dwarf mistletoe. A total of 107 variable radius plots (10 BAF) was established along roaded areas on the forest. A total of 26.2 percent of the plots had rust infected trees and 17.4 percent of the trees on the plots were infected with rust.

DIPLODIA TIP BLIGHT: *Diplodia pinea*

Distribution Map

This blight is the most destructive disease of pines in Kansas and Nebraska. The fungus was confirmed in the following counties in Kansas:

Graham
Harvey
Leavenworth
McPherson
Marion
Morris
Ottawa
Republic
Riley
Stevens

Austrian pine was the most commonly damaged species followed by ponderosa pine and Scots pine.

ASH HEART ROT: *Fomes fraxinophilus*

Fig. 5

During the last 15 years, incidence of heart rot has increased in many tree species in windbreaks established during the Prairie States Forestry Project (1935-1942). A survey is now underway to determine the geographic distribution and incidence of green ash heart rot in Nebraska. Preliminary data indicated that the fungus was present in the following counties of Nebraska:

Antelope
Box Butte
Butler
Cass
Cherry
Custer
Holt
Howard
Jefferson
Lancaster
Madison
Merrick
Morrill
Nucholls
Platte
Polk
Saunders
Scottsbluff
Seward
Sheridan
Sioux
Thayer
Thomas
York

The fungus was found in approximately 5 percent of the trees examined in the central and eastern counties of Nebraska; whereas, incidence in the west was much lower. Infection by this fungus resulted in increased wind breakage of affected trees.

TWIG BLIGHT: *Phomopsis juniperovora*

This disease is a serious problem in juniper plantings established in the 1930's in Kansas. Diseased trees were detected in the following counties of the state:

Butter
Cheyenne
Clay
Cloud
Douglas
Edwards
Ford
Gray
Jewell
Lane
Marshall
Meade
Montgomery
Morris
Ness
Osage
Reno
Republic
Riley
Sedgwick
Sherman
Stevens

SIROCOCCUS TIP BLIGHT: *Sirococcus strobilinus*

Tip blight was identified on Colorado blue spruce in Kansas, a new record for the state. The disease was detected in the following eight counties: Cheyenne, Cloud, Johnson, Morris, Pottawatomie, Russell, Sedgwick, and Stevens. Tree losses were not determined; however, the disease may be widespread due to increased planting of spruce trees in the state.

HACKBERRY DECLINE: Unknown etiology

Hackberry trees at several locations in Kansas and South Dakota were affected with an unknown malady. The decline was most prevalent in the central counties of Kansas and Bon Homme and Hanson counties in South Dakota. This problem has increased in severity for the past three years in Kansas. Symptoms are first observed on one or several limbs on which the leaves become chlorotic with mosaic patterns not unlike those symptoms caused by several viral diseases. A premature leaf drop occurs followed by dieback of branches. During a span of several years, almost all of the tree is affected. No pathogen has been identified as the cause.

OTHER STEM DISEASES

Thyronectria canker of honeylocust, caused by *Thyronectria austro-americana,* was first reported in Colorado in 1976. Since that time the fungus has been isolated from diseased or dead trees throughout the Metro Denver area, Boulder, Rocky Ford and Canon City. The cultivar "Morraine" and "Sunburst" appear to be most susceptible. Russian-olive canker, caused by *Botryodiplodia theobromae,* was observed causing light damage in scattered areas of eastern Colorado and throughout South Dakota. Another canker organism of Russian-olive, *Nectria cinnabarina,* was found in Harvey and Douglas counties, Kansas. Siberian elm canker, caused by *Botryodiplodia hypodermia,* was reported in seven counties in eastern and central Nebraska.

Western gall rust, caused by *Endocronartium harknessii,* was found to be relatively heavy in several ornamental plantings of ponderosa pine in Rapid City, South Dakota. The pathogen was also found throughout ponderosa pine plantations in the Bessey Division of the Nebraska National Forest.

Cytospora canker, *Cytospora annularis,* was found on green ash in Alamosa, Colorado and on mountain ash in Ellis county, Kansas. Another Cytospora species, *C. chrysosperma,* was common on native cottonwoods in natural stands and ornamental plantings in eastern Colorado. The disease was reported on cottonwood in the following Kansas counties: Butler, Ford, Geary, Harvey, Lowe, and Rush. Neither of these diseases appeared to be serious. The increased incidence of Cytospora cankers may be drought-related.

VASCULAR WILTS

DUTCH ELM DISEASE: *Ceratocystis ulmi*
Distribution Map

Dutch elm disease was confirmed in 2,125 trees in Colorado in 1977, including one new county, Cheyenne. Seventy-two percent of the confirmed cases were removed and/or treated. Forty-one municipalities and two counties are removing all diseased elm wood before new broods of the lesser European elm bark beetle, *Scolytus multistiatus*, develop. These areas are to be commended for their efforts, especially for the prompt removal of brood material.

Colorado received funding in the amount of $229,000 to conduct Dutch elm disease control in four cities as part of a nationwide program of the U. S. Forest Service. Under the guidance of the Colorado State Forest Service, Eaton, Canon City, LaJunta and Yuma will receive assistance in implementing intensive, integrated control of the disease. The main purpose of the project is that these communities serve as demonstration areas showing the effectiveness of an integrated control program in reducing elm losses. Hopefully the results can be applied state-wide and nationally.

The disease was found for the first time in four counties of South Dakota: Faulk, Hyde, Jones, and Sully. Several communities in the southeast corner of the state reported a decline in disease incidence over previous years. In other communities, the number of Dutch elm disease infected trees more than tripled over 1976. In the 29 towns reporting in eastern South Dakota, 5,101 cases of Dutch elm disease were identified and the trees removed. In Kansas, the percentage of elm dying from the disease appears to be decreasing.

OAK WILT: *Ceratocystis fagacearum*
Distribution Map

Oak wilt was found in Rice and Montgomery counties, Kansas for the first time. Infection of residential trees in Leavenworth, Johnson, and Pottawatomie counties in Kansas caused concern. The disease was also suspected in several oak stands east of Sioux Falls, South Dakota.

VERTICILLIUM WILT: *Verticillium albo-atrum* (= *V. dahliae*)

Verticillium wilt was found causing minor damage to maple and Russian-olive in Kansas and to maple in Wayne county, Nebraska.

FOLIAGE DISEASES

DOTHISTROMA NEEDLE BLIGHT: *Dothistroma pini*

After several years of relatively low infection in eastern Kansas and Nebraska, infection of Austrian pine was unusually high due to favorable moisture conditions for disease development during July, August, and September. The pathogen caused extensive damage to approximately 10 acres of Christmas trees in Geary county, Kansas. Approximately 75 percent of the pines exhibited severe needle necrosis and premature needle cast. The fungus caused minor damage in Lancaster county, Nebraska.

KABATINA TIP DIEBACK: *Kabatina juniperi*

Fig. 6

This tip dieback of eastern redcedar was found in the following counties of Nebraska: Cass, Johnson, Fillmore, Lancaster, and Holt. The extent of damage is currently unknown.

OTHER FOLIAGE DISEASES

A blight of eastern redcedar, caused by *Cercospora sequoiae* var. *juniperi*, was found on 12 to 15-year-old trees near Pierre, South Dakota.

The brown spot needle blight fungus, *Scirrhia acicola,* caused infection of Scots pine in some areas of Kansas. Because of high moisture conditions, infection was greater in 1977 than in previous years. Walnut anthracnose, incited by *Gnomonia leptostyla,* caused slight damage throughout Kansas.

ABIOTIC DISEASES

WALNUT DECLINE

A decline of walnut was observed in Clay county, South Dakota and the following counties in Nebraska: Burt, Cass, Cumming, Dakota, Dixon, Dodge, and Thurston. Symptomatic trees displayed crown dieback and extensive epicormic branching. The exact cause of the decline was not discovered; however, a spring freeze during May 1976, coupled with the extremely dry summer of 1976, was thought to be the major contributing factor in tree decline.

WEATHER DAMAGE

A dieback of cottonwood caused concern in populated areas of Morris, Lyon, and Sedgwick counties, Kansas. Low winter temperatures of 1976 thru 1977 and other stress factors, such as excessive dry and wet periods, were likely involved.

Drought stress was evident on many species of urban trees in Colorado where water restrictions were imposed. Needle drop was reported in blue spruce and Scots pine plantings throughout Kansas.

Leaf scorch due to high temperatures was found on miscellaneous hardwoods in northern Kansas during July.

NURSERY DISEASES

Fig. 7 & 8

Approximately 20 percent of 1-0 Engelmann spruce seedlings were lost during 1977 at the U. S. Forest Service, Mt. Sopris Tree Nursery, Carbondale, Colorado in some of the beds that had been fumigated with Dowfume ® MC-33 at a rate of 400 lbs/acre the previous fall. *Fusarium* spp. were isolated from diseased seedlings but not confirmed as the primary cause of mortality.

Population estimates of pathogenic species of *Pythium* and *Fusarium* in the soil were made four days after removal of the plastic tarp. The numbers of propagules per gram of soil were determined by plating soil samples onto selective media. Soil samples were taken at 3 depths in one block; in addition, a sample of the top 15 cm of soil was taken in 5 blocks. Populations of the pathogens and weeds were reduced to 0 in the top 15 cm of soil by fumigation. In the future, fungal populations will be compared to disease incidence in order to predict losses and need for disease control.

Phomopsis blight (Fig. 7) was present on 2-0 and 1-0 eastern redcedar and Rocky Mountain juniper at the U. S. Forest Service Bessey Nursery, Halsey, Nebraska, in mid-June. Infection was most severe at the margins of the 2-0 blocks and was light along the margin of one 1-0 block that was adjacent to a 2-0 block. Apparently bi-weekly applications of benomyl that were begun in April and continued throughout the growing season prevented significant losses.

Ponderosa pine seedlings lifted from Bessey Nursery have been sampled every other year since 1971, held in a lath house for 2-3 years, and examined for symptoms of western gall rust. Examination of seedlings collected in 1971, 1973, and 1975 indicated rust infection rates of 0.0, 0.1, and 0.5 percent, respectively. The 1977 seedling sample will be examined in 1979. Results of the samples to date indicate a low level of gall rust infection occurred in the nursery. Galls on pines surrounding the nursery are annually rogued to prevent infection of seedlings.

Grey mold, *Botrytis cinerea* (Fig. 8) caused significant mortality of lodgepole pine containerized seedlings at the Colorado Hydroponics Nursery near Lyons, Colorado. Conditions within the affected greenhouse (high humidity and cool temperatures) were ideal for disease development. Seedlings were so densely packed that air movement was limited among trees. As a result, inoculum increased at the base of trees and group mortality occurred. Routine treatment with benomyl was not effective in controlling the disease. Losses were reduced by roguing infected seedlings, alternating the application of several different fungicides, and and adding a detergent to fungicides for greater penetration and coverage of seedlings.

In 1976, containerized ponderosa pine were inoculated with vegetative mycelia of the mycorrhizal fungus *Pisolithus tinctorius*. The first group of outplanted mycorrhizal seedlings died of drought; another group was planted on the San Juan National Forest in 1977. Field survival will be evaluated in 1978.

Three types of ectomycorrhizal inoculum were used to inoculate containerized lodgepole pine and Engelmann spruce seedlings at the Mt. Sopris Tree Nursery this past year. The inoculum types were (1) partially decomposed sawdust, possibly containing ectomycorrhizal fungi; (2) forest duff, a readily available but highly variable source of inoculum; and (3) laboratory-grown *P. tinctorius* vegetative mycelium, which will be mass-produced commercially in the near future. An evaluation of the various inoculum types will be available in 1978.

Four nurseries in Region 2 are participating in a nationwide test of commercially-produced (by Abbott Laboratories) vegetative mycelia of *P. tinctorius*. The program, designed and coordinated by the Institute for Mycorrhizal Research and Development (U. S. Forest Service) and Southeastern Area, State and Private Forestry (U. S. Forest Service), was initiated in the spring of 1977 at Bessey Nursery, Mt. Sopris Tree Nursery, Big Sioux Conifer Nursery, and Colorado State Forest Service Nursery, Fort Collins, Colorado. The fungus being tested has significantly increased survival of outplanted pines on adverse sites in the Southeast.

The identification and isolation of native mycorrhizal fungi in Colorado was continued. Cultures obtained in 1977 will be evaluated for effectiveness in producing vegetative inoculum in artificial culture.

FI&DM WORKSHOPS

During the past year the Forest Insect and Disease Management Staff offered classroom and field training in the recognition and suppression of major forest insect and disease pests in the Region. Training consisted of two-day workshops held on the Arapaho and Roosevelt and White River National Forests, and in the Regional Office. A total of 41 persons attended the three workshops.

The Workshops are available on a request basis to all federal agencies for which FI&DM has responsibility for insect and disease detection and evaluation. State forestry personnel are also welcome to attend these sessions.

Plans are to conduct four training sessions each year. They are scheduled in late spring and late fall, so as to not conflict with normal field activities.

TABLE 1

OTHER NOTEWORTHY INSECTS

Name	Host(s)	Locality	Remarks
Acronicta americana American dagger moth	silver maple	Larimer County, Colorado	Moderate to heavy defoliation on ornamentals
Ackididae Short-horned grasshoppers	shelterbelt tree species	Fort Morgan, Chatfield and Pueblo Reservoir's, Colorado	Heavy localized defoliation
Aegeria tibiulis Ash & privet borer	green ash, privet	Farm Island State Park, South Dakota	Moderate to heavy damage in shelterbelts
Alsophilla pometaria Fall cankerworm	hardwood species	Southwestern South Dakota	Localized heavy defoliation
Buprestidae Flat-headed wood borer *Cerambycidae* Round-headed wood borer	hardwoods softwoods	Colorado, Kansas, and South Dakota	Reported emerging from prefabricated log homes and firewood. Some badly weakened trees were reported killed in Kansas.
Choristoneura conflicta Large aspen tortrix	aspen	LaVeta Pass, Colorado	Associated with western tent caterpillar infestation in the same area.
Choristoneura pinus *C. lambertiana ponderosana* Pine budworms	ponderosa pine	Colorado Front Range	Moderate populations
Chrysomela scripta Cottonwood leaf beetle	cottonwood	Gunnison, Colorado; water courses in Colorado and South Dakota	Moderate to heavy skeletonization of cottonwood leaves.
Chrysomela tremulae Aspen leaf beetle	aspen	Limestone Plateau, Black Hills National Forest, South Dakota	Heavy defoliation from this insect and the aspen leaf miner
Coloradia pandora Pandora moth	lodgepole & ponderosa pine	Colorado Front Range, Souix County, Nebraska	A few adults found along the Front Range, one land owner with heavy defoliation on ornamental pines in Nebraska
Coleonichtes spp. Pine needle miners	ponderosa pine, pinyon	Colorado Front Range, southern	Light to moderate mining on Front Range, moderate damage on pinyon in Southern Colorado.
Corythuca ciliuta Sycamore lace bug	sycamore	throughout Kansas	Scattered moderate damage
Datana integerrima Walnut caterpillar	walnut	throughout Nebraska	Scattered light to moderate damage
Dendroctonus adjunctus Round-headed pine beetle	ponderosa pine	Mancos, Pagosa Springs, and Stonewall, Colorado	Localized tree killing

TABLE 1

(continued)

Dendroctonus valens Red turpentine beetle	ponderosa pine	Colorado Front Range, Black Hills, So. Dak.	Light infestations
Eriophyes parapopuli Poplar bud gall mite	poplar and cottonwood	Southwest South Dakota and Black Hills	Scattered damage to poplars and cottonwood ornamentals and trees in stream bottoms.
Gossypona spuria European elm scale	elm	Denver, Fort Collins	Populations on ornamentals up from previous years.
Homadaula anisocentra Mimosa webworm	honeylocust, mimosa trees	Eastern Kansas	Heavy localized infestations in urban forested areas on ornamental plantings
Leptocoris trivitatus Boxelder bug	boxelder	Colorado	No appreciable damage to boxelders - nuisance to homeowners by seeking shelter in dwellings
Lesperisinus spp. Ash bark beetle	ash	CSFS tree nursery	Crown killing in a windthrow at the nursery
Matsucoccus acalyptus Pine needle scale	ponderosa pine, pinyon	Colorado	Light infestation on Front Range ponderosa pine and moderate to heavy damage on pinyon in the Southwest.
Monoctenus milliceps Eastern cedar sawfly	cedars	Eastern Nebraska	Moderate to heavy damage on ornamental cedars
Neopasisia menapia Pine butterfly	ponderosa pine	Colorado Front Range	Adults observed in flight, defoliation not noticable
Nymphalis antiopa Spiny elm caterpillar Morning cloak butterfly	elm, willow	Colorado, South Dakota	Individual defoliated elms along the Colorado Front Range, scattered heavy defoliation of willows throughout South Dakota
Paria quadrinotata Black walnut leaf beetle	walnut	Nebraska	Light to moderate defoliation in the eastern part of the state
Papillio spp. Tiger swallowtails	green ash	Colorado	Light to moderate defoliation scattered throughout the state
Pachypsilla celtidismamma Hackberry nipple gall maker	hackberry	Colorado	Heavy damage scattered throughout the state
Paleacrita vernata Spring cankerworm	hardwoods	South Dakota	Heavy scattered defoliation on the southwest
Phenacaspis pinifoliae *Toumeyella numismaticum* Pine tortoise scales	ponderosa pine	Colorado	Moderately infested pines in Boulder area
Phyllocnistis populiella Aspen leaf miner	aspen	Black Hills, South Dakota	Heavy damage on aspen in South Dakota and Wyoming. Particularly heavy defoliation on the Limestone Plateau, associated with the aspen leaf beetle.

TABLE 1

(continued)

Phyllonorycter salicifoliella Willow leaf beetle	willow	Gunnison, Colorado	Moderate to heavy defoliation on private lands near Gunnison.
Phthorephloeus spp. *Scotytus muticus* Hackberry bark beetles	hackberry	Nebraska	Scattered mortality throughout Nebraska
Pissoides terminalis Lodgepole terminal weevil	lodgepole pine	North Colorado	Moderate killing of leaders in lodgepole pine plantings on BLM land near the Routt National Forest and on the Arapaho and Roosevelt National Forests.
Pityophthorus spp. Twig beetles	ponderosa pine, true firs	Colorado and Wyoming	Moderate ponderosa pine branch killing in southwest Colorado. Tip killing on true firs on BLM land near Encampment, Wyoming.
Podosesia syringiue fraxini Ash and privet borer	ash and privet	South Dakota	Moderate to heavy damage to planting at Farm Island State Park,South Dakota.
Pristiphora erichsonii Larch sawfly	larch	eastern Nebraska	Moderate scattered defoliation
Pulvinaria innumerabilis Cottony maple scale	silver maple, honeylocust	Fort Collins, Greeley, & Berthoud, Colorado	Minor damage to ornamentals
Recurvaria spp. Pine needle miner	ponderosa pine	Colorado	Moderate to heavy crown discoloration near Boulder
Scolytus ventralis Fir engraver	Douglas-fir	Wyoming	An infestation spotted by aerial detection on the northwest Bighorn National Forest
Sirex spp. *Tremex columba* Horntail wasps	pine	Colorado	Damage on ornamentals near Denver, and Stonewall, Colorado.
Taniva albolineanu Spruce needle miner	spruce	Nebraska	Crown discoloration reported on ornamental plantings
Thyridopteryx ephemeraeformis Bagworm	hardwoods	Kansas	Common throughout the state
Tylonotus bimuculatus Ash and privet borer	ash & privet	Farm Island State Park, South Dakota	Heavy damage in shelterbelts

TABLE 2 ESTIMATES OF COMMERCIAL ACREAGES OF LODGEPOLE PINE INFESTED WITH DWARF MISTLETOE. R-2.

NATIONAL FOREST	SIZE CLASS	TOTAL ACRES	% INFESTED WITH DWARF MISTLETOE
BIGHORN	Sawtimber	136,000	40
	Pole	113,000	16
	Seedling - sapling	51,000	10
SHOSHONE	Sawtimber	74,000	58
	Pole	84,000	24
	Seedling - sapling	1/	1/
MEDICINE BOW	Sawtimber	209,000	76
	Pole	95,000	55
	Seedling - sapling	64,000	37

1/ Figures not available.

FIGURE 1

(a) Mountain pine beetle, *Dendroctonus ponderosae*, adult. Note how the head shows partially.

(b) Pine engraver, *Ips* spp., adult. Note that head is hidden because of the position of the elytra.

(c) Flat-headed wood borer, *Buprestidae*, adults.

(d) Flat-headed wood borer larva

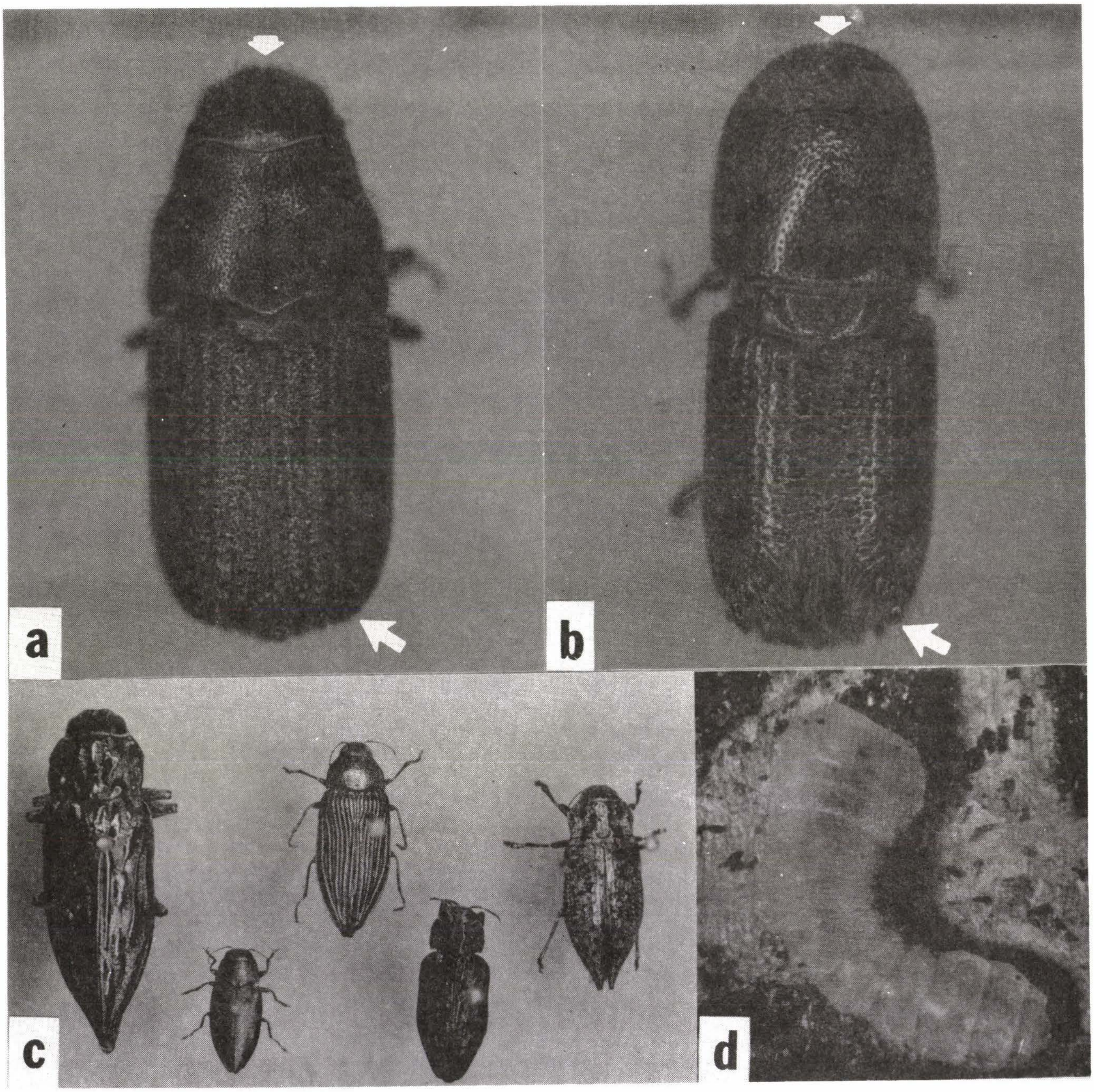

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FIGURE 2

WESTERN BALSAM BARK BEETLE

Dryocetes confusus

(a) *Abies* spp. killed by *D. confusus* (light crowned trees in background)

(b) *D. confusus* adults, note the comb on the frons in front of eyes of the female

(c) Larval galleries

(d) Typical star-shaped egg gallery pattern

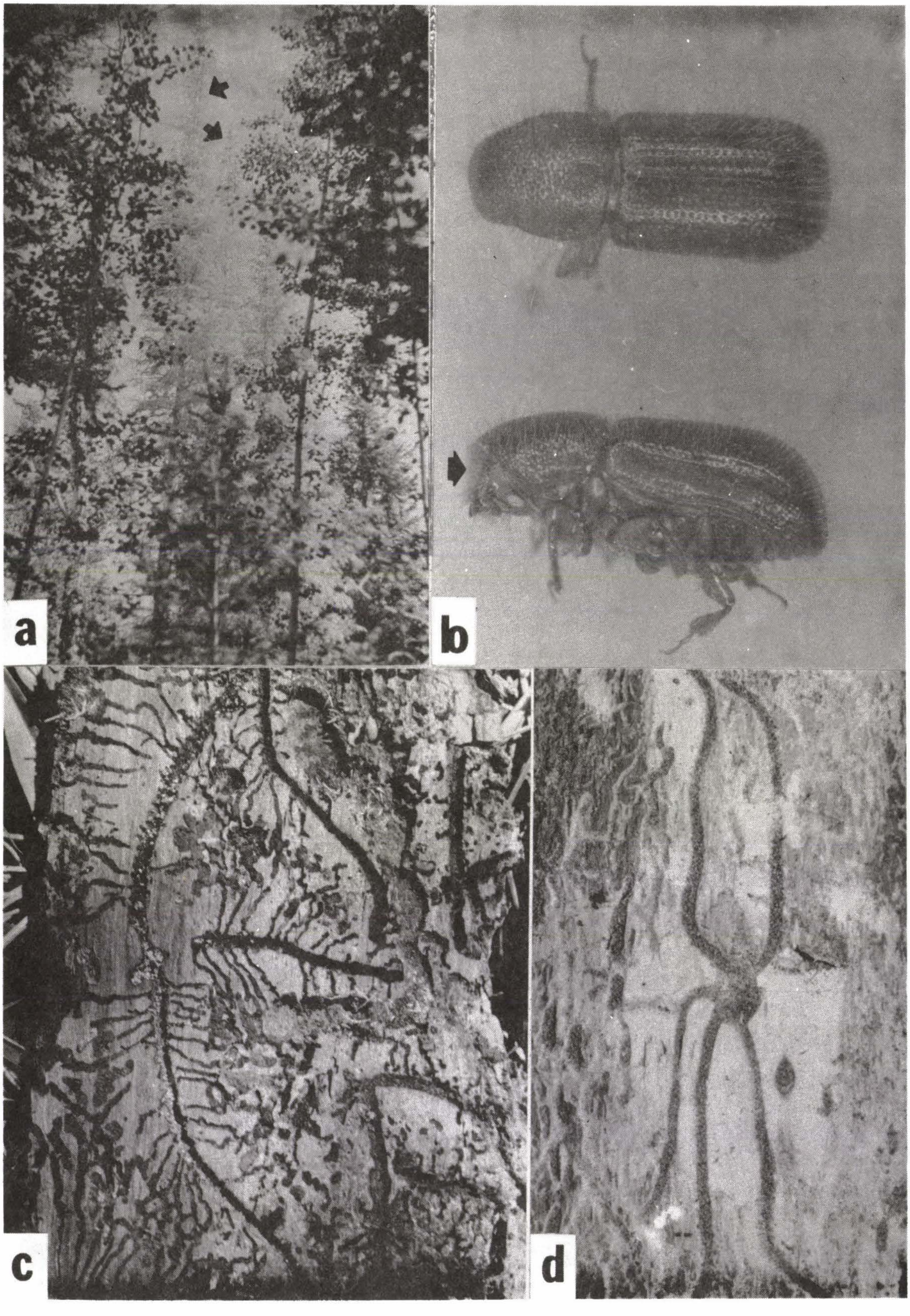
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FIGURE 3

WESTERN TENT CATERPILLAR

Malacosoma californicum

(a) Tents on defoliated quaking aspen

(b) Egg mass on aspen twig

(c) Larvae in nest on aspen

(d) Cocoon

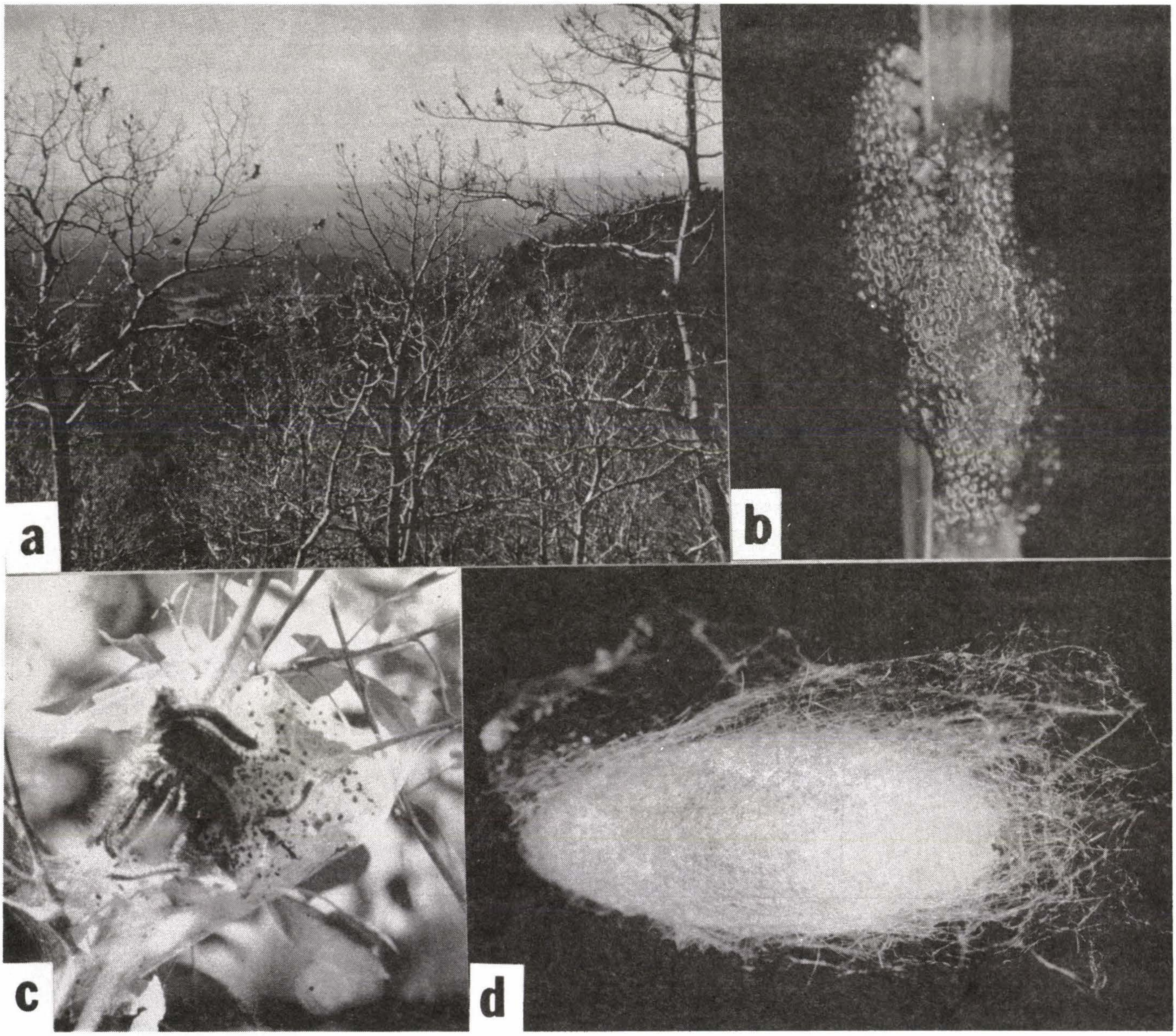
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FIGURE 4

PITCH-NODULE MOTH

Petrovia spp.

(a) Pitch mass over entrance hole on ponderosa pine leader

(b) Pupa exposed in pitch mass on ponderosa pine

(c) adult

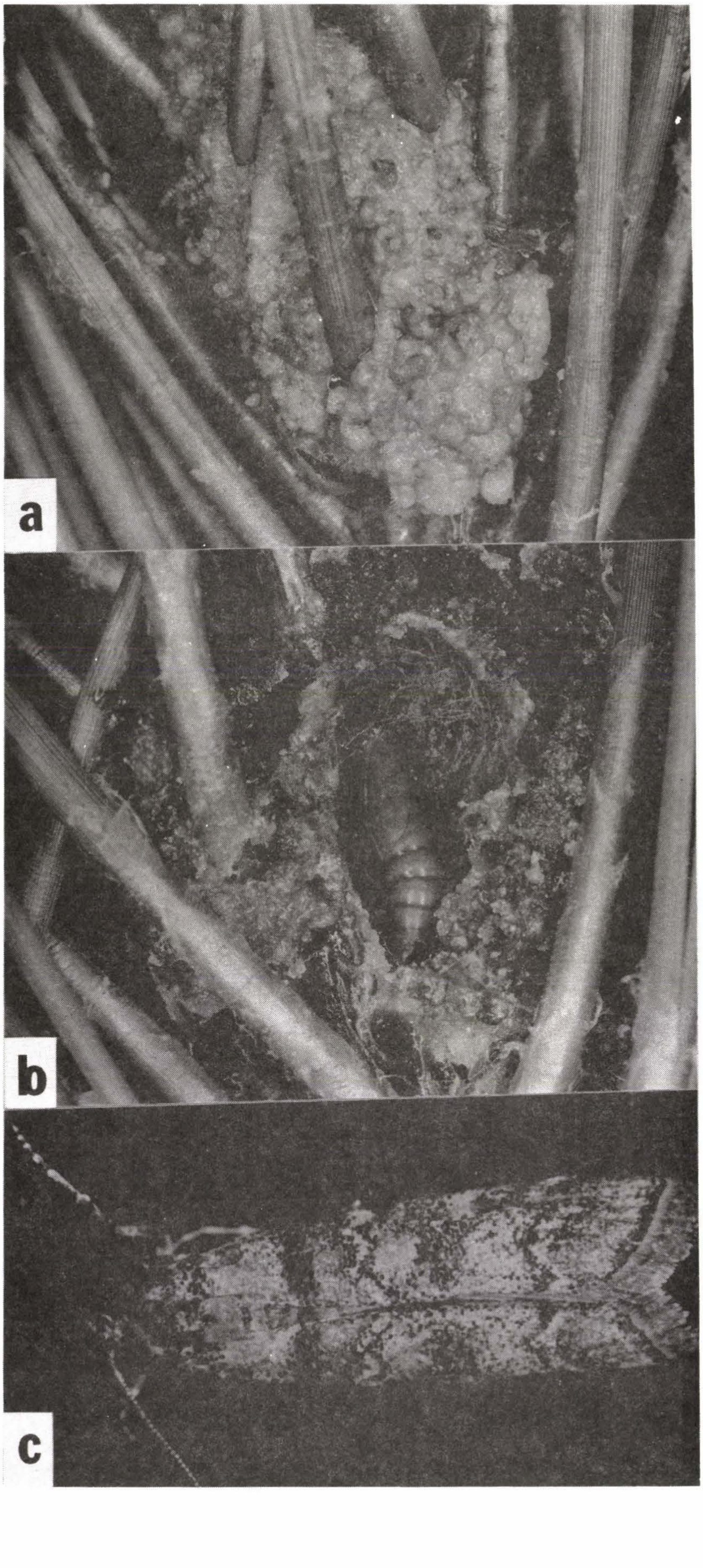
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FIGURE 5

HEART ROT OF GREEN ASH

(a) Typical shelterbelt in Nebraska and survey party

(b) Green ash with sporophores of *Fomes fraxinophilus* (note arrows)

(c) Closeup of *F. fraxinophilus* sporophore

(d) Cross-section of a limb showing decay behind a sporophore

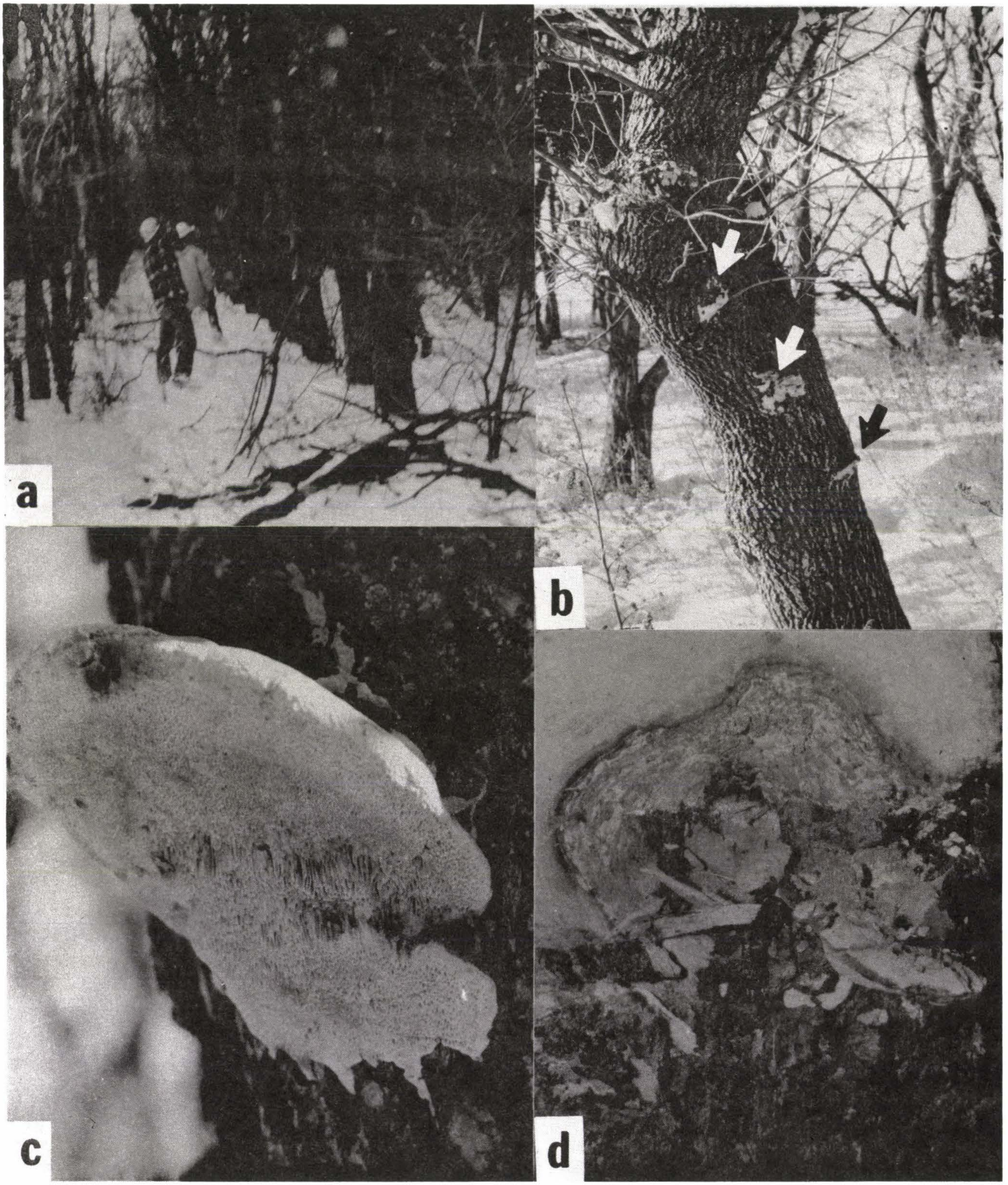
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FIGURE 6

KABATINA TIP DIEBACK OF RED CEDAR

(a) Dieback of branch tips on *Juniperus virginiana*

(b) Closeup of foliage symptoms (dead branch - arrow)

(c) Acervuli (arrow) of *Kabatina juniperi* on *J. virginiana*

(Credit for photographs (a) and (c) is given to the Department of Plant Pathology, Institute of Agriculture and Natural Resources, University of Nebraska, Lincoln)

a
b
c

FIGURE 7

PHOMOPSIS BLIGHT OF JUNIPER

(a) Bed of 2-0 eastern redcedar showing loss (arrows)

(b) 2-0 cedar with dead foliage and pycnidia (arrow) (X 3)

(c) Close-up of infected needle with pycnidia (arrow) (X 10)

(d) Microscopic view of spore with 2 oil globules (X 5000)

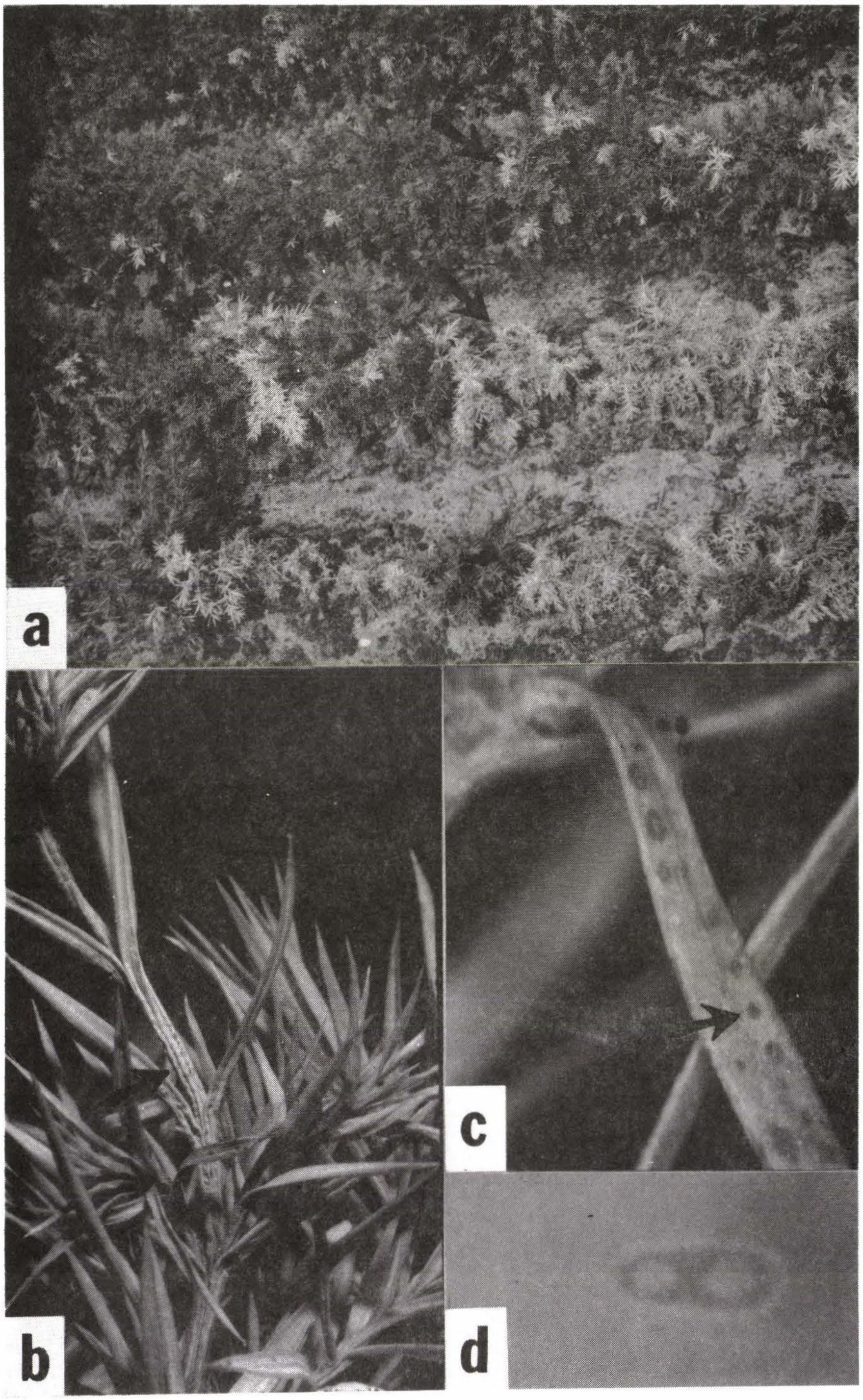
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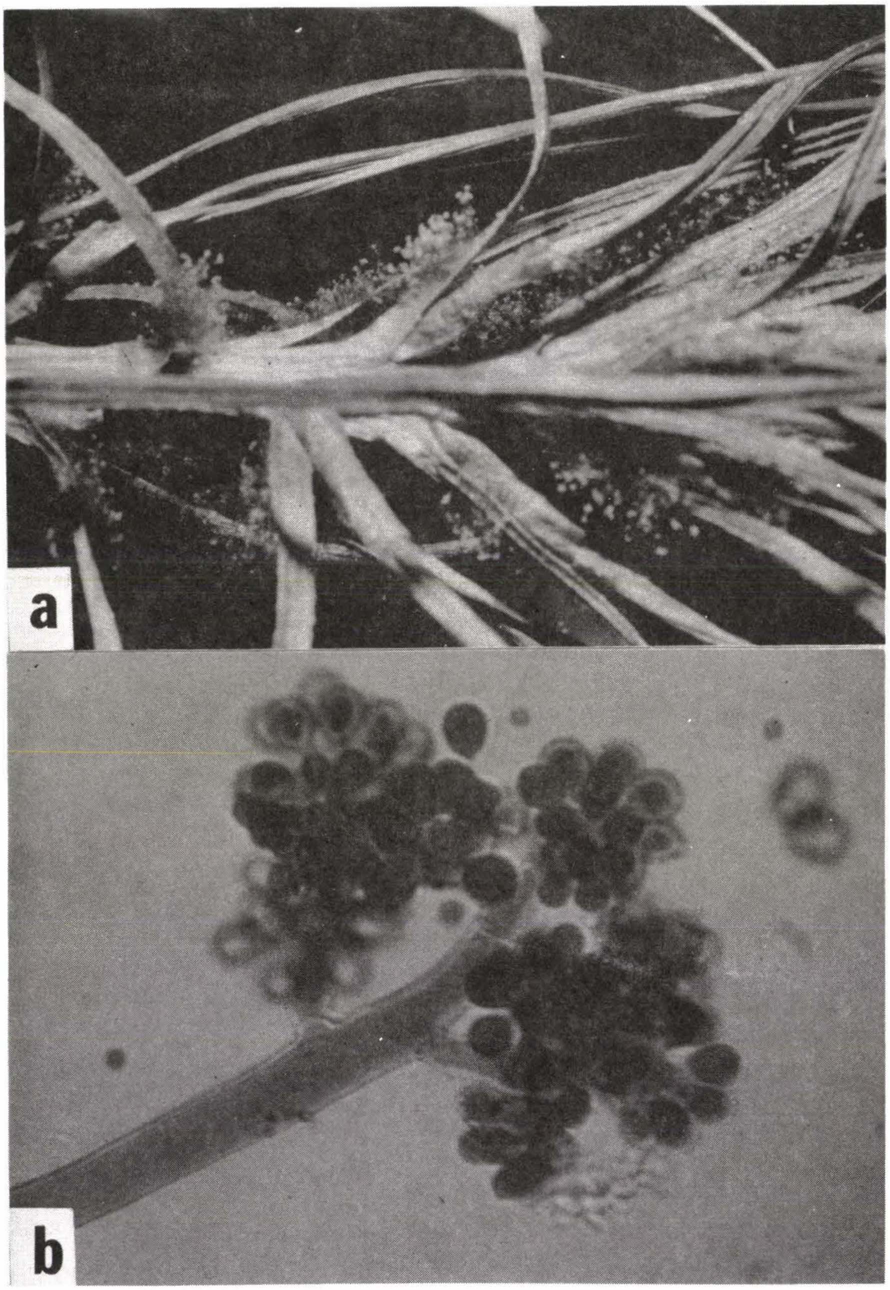
FIGURE 8

GREY MOLD OF LODGEPOLE PINE

(a) Containerized lodgepole seedling showing fruiting bodies and necrosis (X 4)

(b) Microscopic view of conidiophore with spores (X 2000)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FOREST SERVICE, USDA, DETECTION REPORT

FOREST INSECT AND DISEASE DAMAGE

R-2 5200-1

To encourage forest pest reporting for the Rocky Mountain Region, we invite all interested agencies to complete Form R-2 5200-2. Instructions for completing the form are found at the top of the page on each form.

Copies of R-2 5200-1 are available upon request from the Forest Service, State and Private Forestry, Forest Insect and Disease Management, 11177 West 8th Avenue, Post Office Box 25127, Lakewood, Colorado 80225, Phone (303) 234-4877.

Whenever possible, insect or disease specimens or damage samples should be submitted with the form. Resource managers of Federal forest lands should submit specimens for identification to the Forest Insect and Disease Management Staff at the above address. Managers of non-Federal forest lands in Colorado, Kansas, Nebraska, South Dakota, and Wyoming should send detection reports and specimens to their respective state forestry organizations. A complete listing follows:

STATE FORESTRY ORGANIZATIONS

Colorado State Forest Service
State Forester - Thomas B. Borden
Colorado State University
Fort Collins, Colorado 80523
Telephone: (303) 482-8185,
491-6304/6305
Telephone: (605) 224-3481
Kansas State and Extension Forestry
State and Extension Forester
Harold G. Gallaher
Forestry Building, 2610 Claflin Road
Manhattan, Kansas 66502
Telephone: (913) 532-5752

Nebraska State and Extension Forestry
Chairman, Department of Forestry and
State Forester - Dr. Mitchell D. Ferrill
201 Miller Hall, University of Nebraska
Lincoln, Nebraska 68583
Telephone: (402) 472-2944

South Dakota State Division of
Forestry
Director of Forestry -
James D. Verville
Sigurd Anderson Building
Pierre, South Dakota 57501

Wyoming State Forestry Division
State Forester - Carl E. Johnson
1100 West 22nd Street
Cheyenne, Wyoming 82002
Telephone: (307) 777-7586

Form Approved
OMB NO. 040-R-2844

U.S. DEPARTMENT OF AGRICULTURE
Forest Service

DETECTION REPORT
FOREST INSECT AND DISEASE DAMAGE

PART A INSTRUCTIONS: *This report is authorized by the Forest Pest Control Act of 1947. Voluntary responses to the report greatly assist the Forest Service in the detection and prevention of potentially destructive insects and diseases. PRINT. Shaded areas to be completed by FS. Further instructions above.*

1. TYPE OF LANDOWNERSHIP (X Appropriate Box) ☐☐ – ☐☐

☐ Federal ______________ National Forest and District
☐ State ______________ State Forest and District
☐ Private

2. LOCATION OF PROPERTY (Give drainage name, prominent landmark, mileage from known location, etc.)

3. IDENTIFICATION OF PROPERTY (To be completed by FS)

Township	Range	Section	1/4 Section
☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐

4. NAME AND BUSINESS ADDRESS (Include Zip Code)

STATE ☐☐ ______________

COUNTY ☐☐ ______________

5. PHONE NUMBER (Include Area Code)

6. DATE

7. ACTION REQUESTED (X Appropriate Box)
☐ None ☐ Identification ☐ Field Evaluation

8. SAMPLE OF DISEASE (X Appropriate Box) Further Instructions on back.
☐ YES ☐ NO

9. MAP OF AREA ENCLOSED (X Appropriate Box)
☐ Yes ☐ No

10. NUMBER OF ACRES DAMAGED

11. NUMBER OF TREES DAMAGED

12. DISTRIBUTION OF DAMAGE WITHIN THE STAND (X Appropriate Box)
☐ Scattered ☐ Grouped

13. SPECIES AFFECTED (Do not mark in boxes)
☐☐ ______________ ☐☐ ______________ ☐☐ ______________

14. TREE SIZE (X Appropriate Box)
- ☐ – 20 Seedling
- ☐ – 21 Sapling
- ☐ – 22 Pole
- ☐ – 23 Sawtimber
- ☐ – 24 Overmature

15. PART(s) OF TREES DAMAGED (X Appropriate Box)
- ☐ – 30 Root
- ☐ – 31 Bole
- ☐ – 32 Branch
- ☐ – 33 Twig
- ☐ – 34 Leader
- ☐ – 35 New Foliage
- ☐ – 36 Old Foliage
- ☐ – 37 Bud
- ☐ – 38 Cone/Seed
- ☐ – 39 Wood

16. STAND TYPE (X Appro. Box)
- ☐ – 40 Nursery
- ☐ – 41 Plantation
- ☐ – 42 Natural
- ☐ – 43 Shelterbelt
- ☐ – 44 Ornamental
- ☐ – 45 Seed Orchards

17. CASUAL AGENTS OR ASSOCIATED DISTURBANCE (X Appropriate Box)

Insects	Disease	Mechanical		Other
☐ – 50 Bark Beetle	☐ – 60 Root	☐ – 70 Blowdown	☐ – 75 Hail	☐ – 80 Herbicide
☐ – 51 Defoliator	☐ – 61 Foliage	☐ – 71 Thinning	☐ – 76 Snow	☐ – 81 Air Pollution
☐ – 52 Sapsucking	☐ – 62 Decoys	☐ – 72 Logging	☐ – 77 Frost	☐ – 82 Salt
☐ – 53 Borer	☐ – 63 Canker	☐ – 73 Drought	☐ – 78 Wind	☐ – 83 Animal
☐ – 54 Other	☐ – 64 Other	☐ – 74 Flood	☐ – 79 Fire	☐ – 84 Bird

If "other" & known identify: ______________
If "other" & known identify: ______________

18. DAMAGE SYMPTOMS (Enter any pertinent information to indicate severity of damage or symptoms to help identify casual agent. Use TABLE I on instruction sheet above as an aid in describing symptoms.)

PART B – TO BE COMPLETED BY FOREST SERVICE ONLY

1. IDENTIFICATION OF DISEASE (Reply by Entomologist/Pathologist)
☐☐ ______________ ☐☐ ______________ ☐☐ ______________

2. INFORMATION REPORTED (X Appropriate Box)
☐ Reared/Cultured ☐ Sample Damage - Resubmit ☐ Sent out for Identification

3. REPORTED BY (Signature)

4. DATE

5. REPORT NUMBER

Previous editions of this form are obsolete.

5200-1(3/78)
253-174

BIOLOGICAL EVALUATIONS COMPLETED DURING 1977

BY THE

FOREST INSECT AND DISEASE MANAGEMENT STAFF (R-2)

REPORT TITLE	FI&DM FILE DESIGNATION
Examination of Bessey Nursery Stock for Western Gall Rust	R2-77-1
Mountain Pine Beetle. Shoshone National Forest. Bureau of Land Management, State and Private Lands, South Pass City and Atlantic City, Wyoming	R2-77-2
Mountain Pine Beetle. Middle Park, Colorado. Arapaho National Forest, Bureau of Land Management, State and Private Lands.	R2-77-3
Mountain Pine Beetle. National Forest Lands. Colorado Front Range, Arapaho and Roosevelt, Pike and San Isabel National Forests	R2-77-4
Mountain Pine Beetle. Black Hills of South Dakota and Wyoming. Black Hills National Forest and Surrounding Federal, State and Private Lands	R2-77-5
Mountain Pine Beetle. Bighorn National Forest, Wyoming	R2-77-6
Mountain Pine Beetle. Salida and San Carlos Ranger Districts, Pike and San Isabel National Forests. Colorado	R2-77-7

REPORT TITLE	FI&DM FILE DESIGNATION
Surveys of Lodgepole Pine Stands for Dwarf Mistletoe and Comandra Rust. Wind River Ranger District, Shoshone National Forest	R2-77-8
Colorado Front Range Vegetative Management Pilot Project Area - Colorado	R2-77-9
Mountain Pine Beetle. Shoshone National Forest. Bureau of Land Management, State and Private Lands. South Pass City and Atlantic City, Wyoming.	R2-77-10
Mountain Pine Beetle. Shoshone National Forest. Long Creek Timber Sale. Wind River Ranger District, Wyoming.	R2-77-11
Mountain Pine Beetle. Black Hills of South Dakota and Wyoming. Black Hills National Forest and Adjacent State and Private Lands of South Dakota and Wyoming.	R2-77-12
Mountain Pine Beetle. Colorado Front Range. Arapaho and Roosevelt National Forests and Pike and San Isabel National Forests and Adjacent Lands	R2-77-13
Loss of Engelmann Spruce Seedlings at Mt. Sopris Tree Nursery	R2-77-14
Western Spruce Budworm on National Forest Lands in Colorado.	R2-77-15
Phomopsis Blight of Juniper at Bessey Nursery - Nebraska National Forest	R2-77-16

REPORT TITLE	FI&DM FILE DESIGNATION
Evaluation of pathogenic soil fungi at Big Sioux Conifer Nursery	R2-77-17
Soil Fumigation with Methyl Bromide-Chloropicrin at Mt. Sopris Tree Nursery, White River National Forest	R2-77-18
Western Spruce Budworm on Federal and Private lands in the vicinity of Vallecito Reservoir, San Juan National Forest	R2-77-19
Western Tent Caterpillar on the Pagosa District San Juan National Forest	R2-77-20
Aspen Mortality at the Maroon Lake Campground Aspen Ranger District, White River National Forest	R2-77-21
Shoestring Root Rot in a Lodgepole Pine Stand. Poudre Ranger District, Arapaho and Roosevelt National Forests	R2-77-22

TECHNICAL REPORTS COMPLETED SINCE 1976

BY THE

FOREST INSECT AND DISEASE MANAGEMENT STAFF (R-2)

REPORT TITLE	FI&DM FILE DESIGNATION
Tree Hazards: Recognition and Reduction in Recreation Sites February, 1976	R2-1
Soil and Water Quality in Relation to Lodgepole Pine Culture at Mt. Sopris Nursery February, 1976	R2-2
Mycorrhizal Inoculation of Container Grown Ponderosa Pine Seedlings May, 1976	R2-3
Dwarf Mistletoe as a Predisposing Factor for Mountain Pine Beetle Attack of Ponderosa Pine in the Colorado Front Range August, 1976	R2-4
UNASSIGNED	R2-5
Parasitism of Douglas-Fir Tussock Moth Eggs in Denver November, 1976	R2-6
Herbicide Testing at Mt. Sopris Tree Nursery November, 1976	R2-7

REPORT TITLE	FI&DM FILE DESIGNATION
Sodium Fluoraluminate as a Pesticide for Controlling Western Spruce Budworm (*Choristoneura occidentalis* Free.) December, 1976	R2-8
Management Guidelines for Lodgepole Pine Stands Infected with Comandra Blister Rust and Dwarf Mistletoe June, 1977	R2-9
Silvicultural Control of Dwarf Mistletoe in Young Lodgepole Pine Stands June, 1977	R2-10
Guidelines for Estimating the Economic Benefits of Mountain Pine Beetle Control Projects June, 1977	R2-11
Ground Tests with Several Insecticides Against the Douglas-fir Tussock Moth in New Mexico November, 1977	R2-12

OTHER NEW PUBLICATIONS OF INTEREST

AMMAN, G. D., M. D. McGREGOR, D. B. CAHILL and W. H. KLEIN. 1977. Guidelines for reducing lodgepole pine losses to the mountain pine beetle in unmanaged stands in the Rocky Mountains. USDA, For. Serv. Intermountain For. and Range Exp. Sta. Gen. Tech. Rep. INT-36, 19 pp.

EDMINSTER, C. B. 1978. RMYLD: Computation of yield tables for even-aged and two-storied stands. USDA, For. Serv. Rocky Mtn. For. and Range Exp. Sta. Res. Paper RM-199, 26 pp.

HAWKSWORTH, F. G. 1977. The 6-class dwarf mistletoe rating system. USDA, For. Serv. Rocky Mtn. For. and Range Exp. Sta. Gen. Tech. Rep. 48, 7 pp.

PETERSON, G. W. 1977. Control of juniper blight caused by *Cercospora sequoiae juniperi*. Am. Nurseryman 145 (12): 13, 50-51.

PETERSON, G. W. 1978. Effective and economical methods for controlling diplodia tip blight. Am. Nurseryman 147 (1): 13, 66, 70, and 72.

SCHMID, J. M. 1977. Guidelines for minimizing spruce beetle populations in logging residuals. USDA, For. Serv. Rocky Mtn. For. and Range Exp. Sta. Res. Pap. RM-185, 8 pp.

STEVENS, R. E. and D. T. JENNINGS. 1977. Western pine-shoot borer: A threat to intensive management of ponderosa pine in the Rocky Mountain Area and Southwest. USDA, For. Serv. Rocky Mtn. For. and Range Exp. Sta. Gen. Tech. Rep. RM-45, 8 pp.

LISTING OF CURRENT FOREST INSECT AND DISEASE PROJECTS FOR THE ROCKY MOUNTAIN REGION [1]

1977

[1] Includes projects conducted by the USDA, Forest Service, State and Private Forestry (USFS - R-2) and Rocky Mountain Forest and Range Experiment Station (RMFRES); Colorado State Forest Service (CSFS); Colorado State University (CSU); Kansas State University (KSU); South Dakota State University (SDSU); and University of Nebraska (UN). Projects are listed in the above order.

FOREST INSECTS

BARK BEETLES

Mountain Pine Beetle

Preventative spraying of carbaryl against mountain pine beetle attacks (USFS - R-2)

Refinement of preventative spraying of carbaryl against mountain pine beetle attacks (USFS - R-2)

Cutting strategies to reduce probability of mountain pine beetle epidemics in lodgepole pine (USFS - R-2)

Comparative study of survey methods for use in mountain pine beetle infestations in lodgepole pine (USFS - R-2)

Aerial survey of the mountain pine beetle in the Black Hills (USFS - R-2)

Aerial survey of the mountain pine beetle in the Colorado Front Range (USFS - R-2)

Build-up ratio survey of the mountain pine beetle in the Black Hills (USFS - R-2)

Build-up ratio survey of the mountain pine beetle in the Colorado Front Range (USFS - R-2)

Screening tests in a search for repellents of mountain pine beetles (RMFRES)

Silvicultural approach to prevention of mountain pine beetle (RMFRES)

Protecting ponderosa pine from attacks by mountain pine beetles (RMFRES)

Spruce Beetle

Post-attack injection of Silvisar 510 (cacodylic acid) in spruce beetle (Coleoptera: Scolytidae) infested trees (USFS - R-2, RMFRES)

Spruce beetle populations in unmerchantable material and stumps resulting from logging spruce beetle populations in blowdown (RMFRES)

Exploratory studies on importance of natural enemies for control of spruce beetle (RMFRES)

Other Bark Beetles

Pheromone trapping of the lesser European elm bark beetle (CSFS; Northeastern Forest Experiment Station, Delaware, Ohio)

Cacodylic acid studies on Dutch elm disease - translocation and effects on bark beetle broods (CSU)

Phermone trapping studies of the elm bark beetle (CSU; CSFS; RMFRES)

Parasite release studies, *Dendroster protuberans* (Hymenopterous parasitoid of Dutch elm bark beetles) (CSU; Colorado Department of Agriculture)

DEFOLIATORS

Douglas-Fir Tussock Moth

Control of Douglas-fir tussock moth with insecticides (CSU)

Spruce Budworm

Ground application of malathion, acephate and carbaryl for western spruce budworm control (USFS - R-2)

Ground application of acephate for western spruce budworm (USFS - R-2)

Spruce budworm egg mass survey (USFS - R-2)

Distribution of spruce budworm eggs and larvae in white fir (RMFRES)

Keys to larval associates of spruce budworm (RMFRES)

Needle Miners

Pinyon needle miner, *Coleotechnites* n. sp., on pinyon (RMFRES, CSU)

Studies of *Contarinia coloradensis* on ponderosa pine (CSU)

Physiological studies of needle gall formation (CSU)

Biology of pinyon needle gall midges (CSU)

Development of an insect-parasite-host population model for the spindle needle midge, *Pinyonia edulieola* (CSU)

Other Defoliators

A biological study of *Halisidota* sp. on ponderosa pine in Colorado (RMFRES)

Evaluation of chemicals for control of elm leaf beetle on Siberian elm (CSU)

REPRODUCTION INSECTS

Tip Moths

Tip moth study in ponderosa pine provenance planting at Horning State Farm, Plattsmouth, Nebraska (USFS - R-2; RMFRES)

Impact of southwestern pine tip moth damage on ponderosa pine regeneration (RMFRES)

Biology of *Petrova luculentana* (RMFRES)

Survey for sources of ponderosa pine "resistant" to *Petrova metallica* (RMFRES)

Distribution of *Petrova luculentana* (RMFRES; ARS, Beltsville, Maryland)

Screening synthetic attractants of male olethreutid moths attacking ponderosa pine (RMFRES; ARS, Beltsville, Maryland)

Studies of tip moth, *Petrova arizonensis*, on pinyon pine (CSU)

Identification, biology and control of pine tip moths in the genus *Rhyacionia* (KSU)

SHELTERBELT INSECTS

Biological evaluation of the spring cankerworm, *Paleacrita vernata* (Peck) (RMFRES)

Borer-drought relationships study in green ash (RMFRES)

Seasonal activity of the carpenterworm (RMFRES)

Tests of insecticides for control of borers in green ash (RMFRES)

Influence of trapping males on the relative abundance of ash borer in North Dakota shelterbelts (RMFRES; Ohio Agricultural Research and Development Center)

Biology and control of insects and related arthropods attacking forest and windbreak tree species (KSU)

Cankerworm control in shelterbelts (SDSU)

SEED AND CONE INSECTS

Seed and cone insects affecting seed production in the Engelmann spruce, *Picea engelmannii* Parry, in the central Rocky Mountains (RMFRES)

OTHER INSECTS

A new species of Glypta (Hymenoptera: Ichneumonidae) from Colorado and Utah (USFS - R-2)

Distribution of the western pine shoot borer (RMFRES)

The effects of sagebrush eradication in insect populations (RMFRES)

Fog as a vehicle for dispersal of *Bacillus thuringiensis* (RMFRES; North Dakota State University)

Arthropod pests of landscape trees and shrubs (CSU)

FOREST DISEASES

DWARF MISTLETOES

Dwarf mistletoe loss assessment (USFS - R-2; RMFRES; Methods Application Group, FIDM, Davis California)

Silvicultural control of dwarf mistletoe in young lodgepole pine stands (USFS - R-2; RMFRES).

Life tables for lodgepole and ponderosa pine dwarf mistletoes (RMFRES)

Resin disease of lodgepole pine dwarf mistletoe (RMFRES; CSFS; CSU)

Life cycle of lodgepole pine dwarf mistletoe (RMFRES)

Taxonomy, host ranges and geographic distribution of the genus *Arceuthobium* (RMFRES)

Ecologic factors affecting the distribution and abundance of dwarf mistletoes (RMFRES)

Distance of pollen dispersal by lodgepole pine dwarf mistletoe (RMFRES)

Economic analysis of dwarf mistletoe control in southwestern ponderosa pine (RMFRES; Intermountain Forest and Range Experiment Station; USFS - R-3)

Development and refinement of yield simulation procedures for dwarf mistletoe infested ponderosa pine and lodgepole pine stands (RMFRES)

Silvicultural control of dwarf mistletoe in a ponderosa pine recreation forest (Grand Canyon National Park, Arizona) (RMFRES)

Silvicultural control of dwarf mistletoe on a large commercial ponderosa pine forest (Mescalero Apache Reservation, New Mexico) (RMFRES)

Evaluation of thinning to various levels in mistletoe-infested ponderosa pine stands (Arizona and Colorado Front Range) (RMFRES)

Development of a computer-based information retrieval system (FAMULUS) for the world mistletoe literature (RMFRES)

Taxonomic status and epidemiology of *Peridermium* rust associated with lodgepole pine dwarf mistletoe (CSU; RMFRES)

STEM RUSTS

Evaluation of the growth and fate of comandra rust cankers on lodgepole pine (USFS - R-2)

Western gall rust: infection and epidemiology in ponderosa pine provenance plantings in Nebraska (RMFRES)

ROOT DISEASES

Surveys of root diseases in managed conifer stands in R-2 (USFS - R-2)

DECAYS

Survey for *Fomes fraxinophilus* heart rot of green ash in Nebraska - Praire States Forestry Project Windbreaks (USFS - R-2; RMFRES, UN)

Rate of deterioration of beetle-killed Engelmann spruce in Colorado (RMFRES)

VASCULAR WILTS

Dutch elm disease survey and evaluation (CSFS)

Dutch elm disease population dynamics (CSFS)

Dutch elm disease control demonstration project (CSFS; Colorado Extension Service; USFS - R-2)

Chemical control of Dutch elm disease (CSU; CSFS)

STEM CANKERS

An evaluation of aspen cankers and stem rots in relation to timber harvesting methods (USFS - R-2, R-3; RMFRES)

Etiology of aspen cankers (RMFRES)

The relationship between Cryptosphaeria canker and Libertella decay of aspen (RMFRES).

Botryodiplodia hypodermia canker of Siberian elm: factors affecting fungal growth and disease development (RMFRES)

Description and development of the imperfect stage of *Cenangium singulare* in aspen (RMFRES; CSU)

Pathogenicity of Ceratocystis and Nectria-like cankers of aspen (RMFRES; North Central Forest and Range Experiment Station; University of Minnesota; Syracuse University)

Study of honeylocust canker, *Thyronectria austro-americana* (CSU)

FOLIAGE DISEASES

Foliage diseases of conifers in the Rocky Mountains and Southwest (RMFRES)

Lophodermium needle casts of Scots pine Christmas trees: biology and control (RMFRES; Northwest Christmas Tree Growers' Association)

Type specimen study of Lophodermia of pines (RMFRES)

Dothistroma pini resistance in ponderosa pine (RMFRES)

Inheritance of resistance to *Dothistroma pini* in Austrian pine (RMFRES)

Investigations of fungus foliar pathogens of *Juniperus* spp. (RMFRES)

Diplodia pinea tip blight of pines: etiology of stem infections (RMFRES)

Control of brown spot of Scotch pine caused by *Scirrhia acicola* (KSU)

NURSERY DISEASES

Evaluation of Bessey Nursery stock for western gall rust (USFS - R-2; RMFRES)

Soil fumigation for production of hardwood nursery stock: effects on seedling growth, mycorrhizae, root-pathogenic fungi and nematodes (RMFRES)

Herpobasidium deformans blight of honeysuckle: infection and control (RMFRES)

Chemical control of Phomopsis blight of junipers (RMFRES; SDSU: Oklahoma State University; University of Missouri; University of Rhode Island)

RECREATION SITE PATHOLOGY

Evaluation of hazardous trees in forested recreation sites and ski areas (USFS - R-2)

Aspen mortality in Rocky Mountain campgrounds (RMFRES)

MYCORRHIZAE

Inoculation of containerized Engelmann spruce and lodgepole pine seedlings with ectomycorrhizal fungi (USFS - R-2)

Indigenous mycorrhizal fungi of Colorado forests as related to successful forest reproduction (USFS - R-2)

Evaluation of *Pisolithus tinctorius* inoculum produced by Abbott laboratories for ectomycorrhizal development on pine species in container and bare-root nurseries in the Great Plains (USFS - R-2, R-8; RMFRES; CSFS; South Dakota State Division of Forestry)

Ectomycorrhizae of container seedlings: production of symbiont inoculum, synthesis of mycorrhizae, and effects on survival and growth of seedlings in field plantings (RMFRES)

Role of ectomycorrhizas in conversion of nitrogen from inorganic to organic forms (CSU)

Selection and induction of drought-resistance in trees from ectotypes in the Colorado Front Range (includes mycorrhizae) (CSU)

Use of mycorrhizal conifers in revegetation of molybdenum mine tailings (CSU)

Photosynthesis, respiration, and carbon distribution as affected by ectomycorrhizal development (CSU)

Sporophore production by mycorrhizal fungi: their importance in iron availability in terrestrial ecosystems (CSU)

Selection of superior tree ecotype - mycorrhizal fungi associations for mineland revegetation (CSU)

Interspecific and interstrain growth characteristics of selected mycorrhizal fungi under combined temperature and water stress (CSU)

OTHER DISEASES

Etiology of an unknown aspen disorder in the Rocky Mountains (RMFRES; CSU)

Stimulation healing of pruning scars in shade trees by chemical sprays (CSU)

Taxonomy of the genus *Ceratocystis* (CSU)

INDEX OF INSECTS

	Reported In The Following States During 1977 1/	Page
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Acronicta americana (Harris)	C	25
Aegeria tibialis (Harris)	SD	25
Alsophila pometaria (Harris)	SD	25
American dagger moth	C	25
Archips cerasivoranus (Fitch)	C	9
Ash and privet borer	SD	25, 27
Ash bark beetles	C, SD	26
Aspen leaf beetle	SD	25
Aspen leaf miner	SD, W	26
Bagworm	K	27
Black walnut leaf beetle	N	26
Boxelder bug	C	26
Buprestidae : Coleoptera	C, K	25
Cerambycidae : Coleoptera	C, K, SD	25
Choristoneura conflictana (Wlk.)	C	25
Choristoneura lambertiana ponderosana (Obraz.)	C	25
Choristoneura occidentalis (Freeman)	C, W	8
Choristoneura pinus (Freeman)	C, SD	25
Chrysomela scripta (F.)	C	25
Chrysomela tremulae (Fabr.)	SD	25
Cinara occidentalis (Davidson)	C	12
Coloradia pandora (Blake)	C, SD	25
Coleotechnites spp.	C	25
Corythucha ciliata (Say)	K	25
Cottonwood leaf beetle	C	25
Cottony maple scale	C	27
Datana integerrima (G. & R.)	N	25
Dendroctonus adjunctus (Blandford)	C	25
Dendroctonus ponderosae (Hopk.)	C, W, SD	6
Dendroctonus pseudotsugae (Hopk.)	C	7
Dendroctonus rufipennis (Kirby)	C, W	7
Dendroctonus valens (LeC.)	C, SD	26
Dioryctria zimmermani (Grote)	C, N	11
Douglas-fir beetle	C	7
Douglas-fir tussock moth	C, W	9
Dryocetes confusus (Sw.)	C, W	8

	Reported In The Following States During 1977 [1/]	Page
Eastern cedar sawfly	N	26
Elm leaf beetle	C, K, SD	10
Elm spanworm	SD	11
Ennomos subsignarius (Hbn.)	SD	11
Epinotia meritana (Hein.)	C	10
Eriophyes parapopuli (K.)	SD	26
European elm scale	C	26
Fall cankerworm	SD	25
Fall webworm	C	9
Fir engraver	C, W	27
Flocculent fir aphid	C	4, 12
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Hackberry bark beetles	N	27
Hackberry nipple gall maker	C	26
Homadaula anisocentra (Merrick)	K	26
Horntail wasps	C	27
Hyphantria cunea (Drury)	C	9
Ips spp.	C	8
Ips pini (Say)	C	8, 14
Larch sawfly	N	27
Large aspen tortrix	C	25
Leperisinus spp.	C, SD	26
Leptocoris trivittatus (Say)	C	26
Lodgepole terminal weevil	C	27
Malacosoma spp.	C, SD	9
Malacosoma californicum (Packard)	C	9
Matsucoccus acalyptus (Herb.)	C	26
Mimosa webworm	K	26
Monoctenus melliceps (Cresson)	N	26
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Mourning cloak butterfly	C, SD	26
Nantucket pine tip moth	K	10
Neodiprion fulviceps (Cresson)	C, N, SD	11
Neophasia menapia (Feld.)	C	26
Nymphalis antiopa (L.)	C, SD	26
Orgyia pseudotsugata (McD.)	C	9
Pachypsylla celtidismamma (Riley)	C	26
Paleacrita vernata (Peck)	SD	26
Pandora moth	C, N	25
Papilio spp.	C	26
Paria quadrinotata (Say)	N	26
Petrova spp.	N	10

	Reported In The Following States During 1977 1/	Page
Petrova metallica (Busck)	SD	10
Phenacaspis pinifoliae (Fitch)	C	26
Phyllocnistis populiella (Chamb.)	SD, W	26
Phyllonorycter salicifoliella (Chamb.)	C	27
Phthorophloeus spp. (= *Phloeotribus* spp.)	N	27
Pine budworm	C, SD	25
Pine butterfly	C	26
Pine engravers	C	8
Pine needle miner	C	25, 27
Pine needle scale	C	26
Pine sawfly	C, N, SD	11
Pine tip moths	C	10
Pine tortoise scale	C	26
Pine webworm	C	11
Pissoides terminalis (Hopk.)	C	27
Pitch-nodule moth	C, N, SD	10
Pityophthorus spp.	C, W	27
Podosesia syringiae fraxini (Luggar)	SD	27
Ponderosa needle miner	C	27
Poplar bud gall mite	SD	26
Pristiphora erichsonii (Hartig)	N	27
Pulvinaria innumerabilis (Rath)	C	27
Pyrrhalta luteola (Muller)	C, K, SD	10
Red turpentine beetle	SD	26
Rhyacionia spp.	C, K, SD	10
Rhyacionia bushnelli (Busck)	SD	10
Rhyacionia frustrana (Comst.)	K	10
Roundheaded pine beetle	C	25
Scolytus multistriatus (Marsh.)	C, K, N, SD, W	18
Scolytus muticus (Say)	N	27
Scolytus ventralis (LeC.)	C, W	27
Sirex spp.	C	27
Short-horned grasshopper	C	25
Spiny elm caterpillar	C, SD	26
Spring cankerworm	SD	26
Spruce beetle	C, W	7
Spruce needle miner	N	27
Sycamore lace bug	K	25
Taniva albolineana (Kearfott)	N	27
Tent caterpillars	C, SD	4, 9

	Reported In The Following States During 1977 [1]	Page
Tetralopha robustella (Zeller)	C	11
Thyridopteryx ephemeraeformis (Haw)	K	27
Tiger swallowtails	C	26
Toumeyella numismaticum (P. & McD.)	C	26
Tremex columba (L.)	C	27
Twig beetles	C, W	27
Tylonotus bimaculatus (Hald.)	SD	27
Ugly nest caterpillar	C	9
Walnut caterpillar	N	25
Western balsam bark beetle	C, W	8
Western pine tip moth	SD	10
Western spruce budworm	C, W	4, 8
Western tent caterpillar	C	
White fir needle miner	C	10
Willow leaf miner	C	27
Wood borers	C, K, SD	25
Zimmerman pine moth	N	11

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[1]
C - Colorado
K - Kansas
N - Nebraska
SD - South Dakota
W - Wyoming

INDEX OF DISEASES AND PATHOGENS

	Reported In The Following States During 1977 1/	Page
Arceuthobium americanum Nutt. ex Engelm.	W	13
Armillariella mellea (Fr.) Karst.	C	8, 13, 14
Ash heart rot	N	15
Black stain root disease	C	8
Botryodiplodia hypodermia (Sacc.) Petr. and Syd.	N	17
Botryodiplodia theobromae Pat.	C, SD	17
Botrytis cinerea (Fr.)	C	21
Brown spot needle blight	K	20
Ceratocystis fagacearum (Bretz) Hunt	K, SD	18
Ceratocystis ulmi (Buism.) C. Mor.	C, K, SD	18
Cercospora sequoiae var. *juniperi* E. & E.	SD	19
Comandra blister rust	W	14, 15
Cronartium comandrae Peck	W	14
Cytospora annularis E. & E.	C, K	17
Cytospora canker	C, K	17
Cytospora chrysosperma (Pers.) F.	C, K	17
Diplodia pinea (Desm.) Kickx	K, N	15
Diplodia tip blight	K, N	4, 15
Dothistroma needle blight	K, N	19
Dothistroma pini Hulb.		19
Drought	C, K	5, 17, 20
Dutch elm disease	C, K, N	4, 18
Dwarf mistletoes	W	13, 14
Endocronartium harknessii (J. P. Moore) Y. Hiratsuka	N, SD	17
Fomes fraxinophilus (Peck) Cooke	N	15
Fusarium spp.	C, SD	5, 21
Gnomonia leptostyla (Fr.) Ces. & de Not.	K	20
Grey mold	C	5, 21
Hackberry decline	K, SD	4, 17
Kabatina juniperi Schneider & v. Arx	N	19
Kabatina tip dieback	N	4, 19
Leafscorch	K	20
Lodgepole pine dwarf mistletoe	W	4, 13
Mycorrhizae	C, N, SD	5, 21

	Reported In The Following States During 1977[1]	Page
Nectria cinnabarina Tode ex Fr.	K	17
Nursery diseases	C, N, SD	21
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Phomopsis blight	N	4, 5, 21
Phomopsis juniperovora Hahn.	K	16
Pisolithus tinctorius (Pers.) Coker & Couch	C, N, SD	21
Pythium spp.	C, SD	5, 21
Russian-olive canker	C, SD	4, 17
Scirrhia acicola (Dearn.) Sigg.	K	20
Shoestring root rot	C	4, 8, 13, 14
Siberian elm canker	N	17
Sirococcus strobilinus Preuss,	K	16
Sirococcus tip blight	K	16
Thyronectria austro-americana (Speg.) Seeler	C	17
Thyronectria canker	C	17
Twig blight	K	16
Verticicladiella wagenerii Kend.	C	8
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Verticillium dahliae Kleb.		19
Verticillium wilt		4, 19
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Walnut decline		4, 20
Weather damage		20
Western gall rust		17, 21

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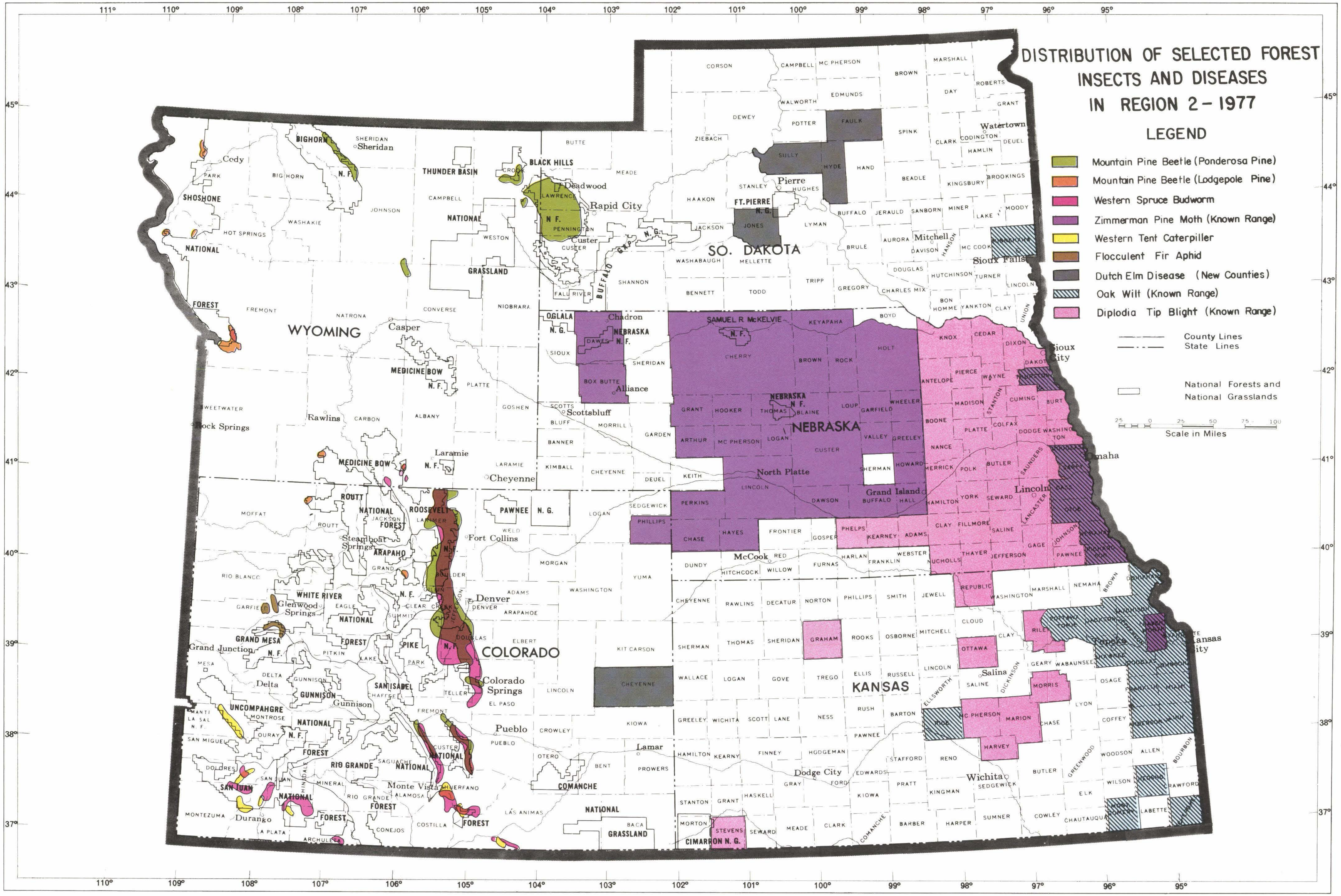
[1]
C - Colorado
K - Kansas
N - Nebraska
SD - Wouth Dakota
W - Wyoming



DISTRIBUTION OF SELECTED FOREST INSECTS AND DISEASES IN REGION 2 - 1977

LEGEND
🟩 Mountain Pine Beetle (Ponderosa Pine)
🟧 Mountain Pine Beetle (Lodgepole Pine)
🟥 Western Spruce Budworm
🟪 Zimmerman Pine Moth (Known Range)
🟨 Western Tent Caterpiller
🟫 Flocculent Fir Aphid
⬛ Dutch Elm Disease (New Counties)
▨ Oak Wilt (Known Range)
🟪 Diplodia Tip Blight (Known Range)
County Lines
State Lines
National Forests and National Grasslands
25 0 25 50 75 100
Scale in Miles
111° 110° 109° 108° 107° 106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96° 95°
45° 44° 43° 42° 41° 40° 39° 38° 37°
WYOMING
SO. DAKOTA
NEBRASKA
COLORADO
KANSAS
Cody
Sheridan
Casper
Rawlins
Rock Springs
Laramie
Cheyenne
Deadwood
Rapid City
Custer
Pierre
Watertown
Mitchell
Sioux Falls
Chadron
Alliance
Scottsbluff
North Platte
Grand Island
Lincoln
Omaha
Sioux City
McCook
Fort Collins
Denver
Colorado Springs
Pueblo
Grand Junction
Glenwood Springs
Steamboat Springs
Delta
Gunnison
Monte Vista
Durango
Lamar
Dodge City
Salina
Wichita
Topeka
Kansas City
SHOSHONE NATIONAL FOREST
BIGHORN N. F.
THUNDER BASIN NATIONAL GRASSLAND
BLACK HILLS N. F.
BUFFALO GAP N. G.
FT. PIERRE N. G.
OGLALA N. G.
NEBRASKA N. F.
SAMUEL R McKELVIE N. F.
MEDICINE BOW N. F.
ROUTT NATIONAL FOREST
ROOSEVELT N. F.
ARAPAHO N. F.
PAWNEE N. G.
WHITE RIVER NATIONAL FOREST
GRAND MESA N. F.
PIKE N. F.
SAN ISABEL N. F.
GUNNISON N. F.
UNCOMPAHGRE NATIONAL FOREST
RIO GRANDE NATIONAL FOREST
SAN JUAN NATIONAL FOREST
COMANCHE NATIONAL GRASSLAND
CIMARRON N. G.